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Determinants of Rural Households' Vulnerability to Poverty in Chencha and Abaya Districts, Southern Ethiopia (Microeconometric Analysis)

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Abstract
This study primarily aimed to examine the determinants of rural households' vulnerability to poverty and to profile the households according to their level of vulnerability using Feasible Generalized Least Square (FGLS) and Logistic Regression analysis with the help of data collected from a sample of 500 households in two Woredas.
The general poverty line of the study area was determined to be Birr 248 per month per adult equivalent and 29.8 percent of the population in the study areas were found to be poor. The projected consumption percapita after the three step FGLS estimation revealed that, the incidence of vulnerability to poverty in the area was 34.2 percent and therefore, vulnerability was more spread in the study areas than ex post poverty.Using the two vulnerability thresholds, observed poverty rate (0.298) and vulnerability of 0.5, about 28.6%, 5.6% and 65.8% of households were highly vulnerable, low vulnerable and not vulnerable respectively. Most importantly, from the total poor households about 81.75%, 3.25% and 15% were highly vulnerable, low vulnerable and not vulnerable respectively. About 36.06% of female headed households were highly vulnerable while 27.56% of male headed households were highly vulnerable.The logistic regression after the three steps FGLS estimation revealed that being female headed households, large family sizes and low access to all season roads and local markets statistically significantly increased the vulnerability of rural households to poverty. But, credit uses, number of livestock, land size, annual farm income and participation in safety net program statistically significantly reduced the vulnerability of rural households to future poverty.Thus, so as to alleviate ex post poverty and prevent ex ante poverty, government should provide credit services, infrastructures, markets services and promote family planning and participation in non-farm activities like micro and small enterprises by rural households. Provision of such services may help rural vulnerable households to build assets thereby resilience to future poverty.
Keywords: Poverty, Vulnerability, Feasible Generalized Least Square, Logit Model and Ethiopia

1. Introduction

In most of developing countries larger population are living in rural than urban areas where about 3.1 billion people live in rural areas out of this about 1.4 billion people live on less than US$1.25 a day. About 70 per cent of the world's very poor people are rural, and a large proportion of the poor and hungry amongst them are children, female and youth (IFAD, 2011).

Poverty continues to be the main challenge in developing countries, especially in sub-Saharan Africa. Three fourths of the poor in the developing world live in rural areas and rural poverty remains high and persistent in SSA (World Bank, 2008). In fact, the burden of poverty in SSA is disproportionately borne by rural dwellers and women (UNECA, 2012).

Nowadays, in Sub Saharan African countries, rural infrastructure has almost deteriorated, productivity has been declined, food systems have stagnated, and inequalities have deepened (UNDP 2012). In spite of the fact that the rapid growth and quick reduction in poverty continue to be seen in Eastern Asia, growth in SSA could not be fast enough to eradicate extreme poverty. Despite the colossal effort made in these countries to eradicate poverty, majority of SSA countries have very low Human Development Index (HDI) and in the year 2011, the 15 lowest ranked countries with HDI were from SSA (UNDP, 2012).

Specifically, poverty is widespread in Ethiopia as a large proportion of its population lives below one dollar a day. Despite rapid economic growth in the past decade, averaged 10.1 percent for the last 11 years, poverty is still prevalent in Ethiopia that makes the country among the poorest in the world. According to UNDP (2012), Ethiopia is ranked 174th out of 187 countries in terms of HDI. Similar to in other developing countries, majority of the poor in Ethiopia live in rural areas (Alemu et al., 2011) where 83 percent of the total population lives (World Bank, 2012).

As part of SSA, Ethiopia faces daunting poverty and food insecurity challenges that are worsening overtime. With a population of about 91.2 million in 2013 and large physical size, the country is one of the largest and the most populous countries in Africa characterized by wide topographic induced variations which help to grow varieties of crops, Von Braun and Olofinbiyi (2007). This implies that given ecological diversity, Ethiopia has wide different varieties of crops and species of livestock. Despite this potential, however, Ethiopia is one of the poorest countries in the world with low annual per capita income, Fransen and Kuschminder (2009).

The majority of Ethiopian population is dependent on rain-fed agriculture as a major source of livelihood, but the agricultural production and productivity showed a declining trend from 1960s onwards, Fransen and Kushminder (2009). The same author further indicated that until the 1950s, Ethiopia was sufficient in staple food and indeed exporter of food crops. From the early 1960s onwards, Ethiopia has experienced poverty and chronic food insecurity mainly caused by high population growth, land degradation, lack of appropriate technologies, land tenure insecurity, scarcity of farmland, drought, variability and unpredictability of rainfall.

There are some achievements in overall reduction on poverty levels but still poverty and food insecurity remain the big challenge. Over 30% of the population is below the poverty line and unable to afford the minimum calorie intake for health and active life, WFP(2014). Poor agricultural harvest due to drought induced calamities with successive failed rain is one of the causes of poverty in Ethiopia especially in rural parts and consequently left a significant number of people to food emergency handout, Temesgen (2016). Land degradation, limited household assets, low level of farm technology, limited diversification of income sources and population pressure are also the underlying causes of rural poverty in Ethiopia, CSA and WFP (2014).

Due to the continued ocean warming effect of El *Nino,* Ethiopia is facing one of the worst crises and from June 2015 on wards the total effect left an estimated 10.2 million people to emergency food aid, USAID (2015) and hence, rural households are falling into food insecurity. Even if the government of Ethiopia established different development projects and programs to address the issue, yet recurring droughts and the population's heavy dependence on rain fed agriculture, which is plagued by low productivity levels, present ongoing challenges for poverty reduction strategies (USAID 2014).

Southern Nations Nationalities Peoples Region (SNNPR) is not exceptional to poverty problem. As Melkamu (2011) noted, food insecurity in SNNPR remains a multifaceted and complex problem in which lack of access as well as availability and quality of food still play an essential role. Several factors should be taken in to consideration including extreme poverty, poor access to infrastructure, lack of productive assets, and weakness in marketing system and transport bottlenecks and others. According to the recent estimate 24% of the total households in SNNPR are found below poverty line with poverty prevalent more in rural areas than urban areas (CSA and WFP, 2014). The poor and the very poor of this region depend on food aid or safety net program to meet 5 - 25% of their basic food requirements even in the normal year (FWES, 2010 cited in Melkamu (2011).

Poverty is usually taken as the lack of necessities though what is a necessity to one individual may not be for the other. Necessities are relative to what is possible usually based on social characterization and past experience (Sen, 1988). However, the most commonly used definition is the one defined by the World Bank (2000) as the economic condition in which people lack sufficient income to obtain certain minimal levels of health services, food, housing, clothing and education generally recognized as necessary to ensure an adequate standard of living.

In recent years there has been increasing awareness that the analysis of poverty should be carried out in dynamic context. It is essential not only to just look at the current incidence of poverty, but also individuals ,households or communities are more at risk of suffering in near future, Thabane (2013). The idea is that over the long periods, there is a situation in which people move in and out of poverty. Being poor today doesn't necessarily imply high probability of being so in future because there may be an improvement in food situation if looking beyond the short run, Babatunde (2008).

Hence, there is a need to move from a mere analysis of current incidence of poverty to a forward looking future incidence of poverty to capture the dynamic and multidimensional concept of poverty. The main analytical concept that has been developed and appeared in poverty literature to address the issue of future incidence of poverty is said to be vulnerability analysis.

However, Vulnerability is a vague concept and its definition varies across disciplines, ranging from engineering to psychology to Economics (Babatunde, 2008). Additionally, owing to its diversity and lack of convergence overtime, no consensus has been reached concerning the definition of vulnerability, Adger (2006). According to Thabane (2013) vulnerability can be defined as the diminished capacity of an individual to anticipate and resist the impact of natural or manmade hazard. The Department for Internal Development, DFID (2008) defines vulnerability as the susceptibility of individuals, households or communities to become poor or poorer as a result of events that affect their livelihood systems. Traditionally, researchers and practitioners are concerned with likelihood of becoming poor (vulnerability to poverty) and this leads to the development of early warning system (EWS).

Though, much attention has been given to defining and assessing vulnerability to poverty there is no unique generally accepted definition of vulnerability (Chaudhuri, 2000). Quisumbing (2002), Christiansen et'al (2004) and McCulloch et'al (2003) defined vulnerability as the ex-ante potential of a decline in future well-being, or the ex-ante probability of falling below the poverty line at some point in the future. Dutta et al., (2010) and Ligon et'al (2003) also defined vulnerability at the individual level can be thought in terms of the uncertainty in the outcomes of different indicators such as income and consumption that the individual faces in the future.

Chaudhuri et al., (2002), on the other hand defined vulnerability within the framework of poverty eradication, as the ex-ante risk that a household will, if currently non-poor, fall below poverty line, or if currently

poor will remain in poverty. According to Moser (1998) and Alwang et'al (2000), vulnerability is closely linked to ownership. The more assets people have the less vulnerable they are, and the greater the erosion of the people's assets, the greater their vulnerability to poverty. According to Dercon (2001), assets must be liquid, i.e. readily changed into cash at minimum cost and must not lose value in the face of the potentially poverty reducing event in order to mitigate risk and exposure effectively. According to Dercon (2001), McCulloch et'al (2003), Christiaensen et'al (2004) and Holzmann et'al (1999), exposure to risks is a major reason for assessing vulnerability of households to poverty. They suggested there is a probability for currently non-poor households to be poor in the future or the probability that currently poor households to continue to be poor in the future. According to them, a high percentage of households move into poverty due to temporary shocks that are reversed just one or two years later. The concept of vulnerability therefore, is dynamic and is broadly an ex-ante or forward looking measure of a household's well-being.

According to Heitzmann, et'al (2002) and Dercon (2001), household assets such as land, labor, as well as physical, human and social capital are deployed to generate income which, in turn, is used to generate well-being largely through consumption and reduce vulnerability to poverty.

Thus, poverty concerns the ex post realization of consumption with respect to a socially determined minimum threshold (poverty line), while vulnerability is the ex-ante expectation of consumption relative to this threshold. Even if the person is not necessarily poor now, it is often associated with the effects of "shocks" such as a drought, a large increase in prices, or a financial crisis. Therefore, vulnerability is a key dimension of well-being since it affects individuals' behavior (in terms of investment, production patterns, and coping strategies) and the perceptions of their own situations.

Survey of literature on poverty and vulnerability shows that even if attention is given to the study of poverty in developing countries, there are relatively fewer empirical studies in the literature on vulnerability of households to poverty. Yet, reducing vulnerability is a pre-requisite for achieving global and national food security targets (Lovendal and Knowles, 2005).

Even if there are a few studies in Ethiopia concerning the vulnerability of rural households to poverty, most of them concentrated in the Northern and eastern parts of the country. For instance, Mesfin (2011), Bogale (2012), Getu (2012), Temegen (2015), and the attention of most these researchers are towards poverty or food insecurity. Therefore, previous studies on vulnerability to poverty are very minimal in Ethiopia as whole let alone SNNPR in which studies focused on vulnerability are rarely found. Therefore the need to undertake the study on analysis of vulnerability of household to poverty in the case study area is owing to the indicated gap in literature.

Thus, for a long period of times, researchers or practitioners have been using ex post measures of poverty which does not tell about future poverty. But, it is not uncommon to see households moving in and out of poverty even in the very short run and therefore, it has a paramount importance to measure and analyze ex ant poverty which is also very important for targeting poverty reduction programs. Thus, the present study examined the determinants of rural households' vulnerability to poverty using Feasible Generalized Least Square (FGLS) methods of vulnerability analysis and profiled the vulnerability of rural households to poverty using the two vulnerability thresholds (mean vulnerability and 50%). Specifically, this study attained the following objectives.

Determination of the poverty line for the study areas using survey data and cost of Basic need (CBN) approaches

a. Determination of the vulnerability (probability of being poor) of each households using FGLS
b. Classification of the households according to their vulnerability to poverty (not vulnerable, low vulnerable and highly vulnerable)
c. Examination of the determinants of rural household's vulnerability to poverty in the study areas using logistic regression.

2. Materials and Methods

2.1 Description of the Study Areas

Southern Nations Nationalities and Peoples Region (SNNPR) is one of the largest regions in Ethiopia, accounting for more than 10 % of the country's land area. The population was estimated at nearly 15,745,000 (CSA 2008), which almost a fifth of the country's population. Southern Nations Nationalities, Peoples Region State (SNNPRS) has 15 zones that consist of a total of 125 Woredas[1], including some autonomous Woredas. Woredas consist of 3561 rural kebeles, 90 town centers and Hawasa is the administrative capital of the region.

Gamo gofa zone is one of the 15 zones in SNNPRS and there are five indigenous ethnic groups in Gamo Gofa Zone with distinct languages and cultural base. The zone has a total area of 12,581.4km2 and administratively consists 15 rural Woredas namely, Arba Minch Zuria, Mirab-Abaya, Boreda, Chencha, Dita, Kucha, Daramlo, Bonke, Kemba, Zala, Ubadebretsehay, Oyida, Demba Gofa, Geze Gofa and Melakoza. Arba Minch town is the administrative and trading center of the zone, located at 505 km from Addis Ababa and 275 km south west of

[1] In this study, woreda and district are interchangeably used

Hawassa. The general elevation of the Gamo Gofa zone ranges from 680 to 4207 meters above sea level.
To achieve the stated objectives, this study mainly depends on the primary sources of data. The primary data were collected via structured questionnaires managed by enumerators from 600 sample households and interviews were held with focus group and community leaders from each sample kebele and some Woreda officials. To complement our primary data sources, some general information about the SNNPR State were gathered from secondary sources such as published and unpublished documents which were obtained from each sample kebele, Woreda and zone offices.

2.2 Sampling Techniques and Sample Size Determination

To achieve the stated objectives, the study mainly used primary data collected from rural farm households in the study area through a structured questionnaire. The total sample size for the study was 500 households which was determined using the sample size determination formula of Yamane Taro (1963) as follow:

$$n = \frac{N}{1 + N(\alpha)^2}$$

Where, N is the total number of households in the Gamo Gofa Zone (296,198), n is the sample size and α is the level of significance for the present study and it is fixed at 5%. The total number of households in Gamo Gofa Zone was 296, 198 according to CSA (2007), and the above formula determined the following sample size for the study.

$$n = \frac{296198}{1 + 296198(0.05)^2} = 399$$

But, to account for the limitation of this sample size determination formula, the researcher increased the current sample size to 500 households. The limitation of Yamane Taro sample size determination formula is that, for any number of population, the sample size never exceeds 400 at 5% level of significance. Thus, these 500 rural households were selected via multistage sampling using both probability and non-probability sampling techniques.

In Gamo Gofa Zone, there are 15 Woredas and from these, in the first stage, two Woredas were purposively selected namely Chencha and Mirab Abaya Woredas, one from low land areas (Mirab Abaya) and the other from high lands (Chencha). There are 23 and 45 rural kebeles in Mirab Abaya and Chencha Woreda respectively. The total population in the study areas were 69133 and 98382 while the total households in the sample Woredas were 12864 and 20340 in Mirab Abaya and Chencha Woreda respectively according to CSA, 2007.Therefore, proportionately 200 and 300 sample households were selected from Mirab Abaya and Chencha Woreda respectively.

In the second stage, six rural kebeles were randomly selected from Chencha Woreda while four rural kebeles were randomly selected from Mira Abaya woreda respectively. This is because, there are 45 rural kebeles in Chencha Woreda while there are 23 rural kebeles in Mirab Abaya Woreda. Finally, primary data were collected from a total of 10 sample kebeles and 500 rural households using systematic random sampling (SRS) technique.

2.3 FGT Measures of Poverty and Concept of Poverty Line

Measuring poverty is another controversial issue in development economics researches. As many scholars differ in their definition of poverty, they also vary in their way of measuring poverty. For some scholar and researchers measuring poverty using income and expenditure measures is the best way to capture the exact characteristics of the poor, whereas others use non-monetary measures of welfare and some others also employ both methods in their study (Tesfaye A., 2006).

It is widely understood that an individual is considered poor if consumption or income level falls below some minimum level necessary to meet basic needs; that is poverty line. Poverty line is a minimum expenditure required to fulfill the basic need. Poverty measurement generally assumes that there exist predetermined and well define standard of consumption called “poverty line” which must be reached if a person is not to be a deemed as poor. It is undeniable that there exist levels of consumption of various goods and services like food; clothing and shelter below which survival beyond short period is threatened, though it is clear what the level exactly are for any given individual (Ravallion M., 1992).

After collecting consumption data from rural households, a poverty line is determined using the cost of basic need (CBN) approaches for further aggregation and analysis of poverty and vulnerability to poverty. The study followed the procedure used by Ravallion & Bidani (1994) so as to determine the poverty line (the minimum income or consumption that help a person to escape poverty). In the CBN approach, first households are ordered ascending according to their consumption per adult equivalent and the poorest 40% of the sample households identified as a reference group.

Following the Revallion and Bidani (1994) method, food consumption behavior of the reference group is accessed to determine average quantities per adult equivalent of basic food items that make up the required food basket. Then, the value of food consumed per adult equivalent is obtained by dividing the total value of food by

household adult equivalent as follow.

$$Y_i = \frac{C_i}{H_i}$$

Where, Y_i, C_i and H_i are total value of food consumed per adult equivalent, total value of food and adult equivalent for j^{th} household. Once consumption per adult equivalent is obtained, the next step is to convert the various types and quantities of foods consumed in to calories by using standard conversion factors. The average quantity per adult of each food item is scaled up and down by a constant value (ration of recommended calorie of per day per adult to the total calorie obtained by individual adult from consuming the average quantities) so as to provide the recommended calorie per adult per day. In this case the study used 2200 calories as recommended calorie per day. Finally, each food item is multiplied by the retail price and summed up to get a food poverty line[1].

Poverty measures are designed to count the poor and to diagnose the extent and distribution of poverty. The income poverty measures proposal by Foster J., Greer J. and Thorbecke E (FGT) in 1984 are used in different researches (Verner D., 2004). This measure of poverty combines three aspects of poverty, which is the extent of poverty (as measured by the head count ratio), the intensity of poverty (as measured by the total poverty gap ratio) and the severity of poverty (as measured by squared poverty gap ratio). The head count ratio defined as the proportion of people below poverty line. One concern in applying this measure is that each individual below poverty line is weighted equally. The general formula for the head count ratio can be written as:

$$P_0 = \frac{Q}{N} \qquad (1)$$

Where, $\mathbf{P_0}$, Q and N are the head count ratio, the portion of the people who live below poverty line and total population respectively.

This measure takes no account of the degree of poverty. So head count ratio fails to capture the extent to which individual income or expenditure falls below the poverty line. And this can be solved by another measurement of poverty, the poverty gap ratio (Verner D., 2004).

One measure of poverty that takes the latter point into account, at least in weak form, is the poverty gap measure. It can be interpreted as a per capita measure of the total economic shortfall to the population. It distinguishes the poor from the not so poor and corresponds the average distance between the income of the poor and the poverty line. The equation that represents the poverty gap ratio is given by:

$$P1 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-Yi}{Z}\right) \qquad (2)$$

Where, P_1, Z , Y_i and N are squared poverty gap, poverty line, level of income, individual level of income and total population respectively. The major problem in this measure is that, it does not concern the importance of the number of people who are below poverty line.

The squared poverty gap measures the severity of poverty and it is sensitive to the distribution among the poor as more weight is given to the poorest below poverty line. It corresponds to the squared distance of income of the poor to the poverty line (Verner D., 2004). The equation for the measures of severity of poverty is:

$$P_2 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-Yi^2}{Z}\right) \qquad (3)$$

Where, P_2, Z , Y_i and N are squared poverty gap, poverty line, level of income, individual level of income and total population respectively.

2.4 Measurements of Vulnerability and the FGLS Model

There is no established consensus in the literature regarding the most appropriate approach of measuring vulnerability. Even if there are many definitions of vulnerability, the real difficulty has been finding a robust measurement of vulnerability that is consistent with basic tenets of risk analysis (Scaramozzino, 2006).

Basically there are two main approaches to vulnerability measurement namely Outcome Approach and Utility based Approach. The outcome approach measures vulnerability in terms of expected poverty (Chaudhuri, 2001; Chaudhuri, Jalan and Suryhadi, 2002; Azam and Imai, 2009). The utility based approach measures vulnerability as the difference between utility of household would derive from the consumption of a particular bundle with certainty and the expected utility of consumption (Ligon and Schecter, 2003, 2004).

Even if there is no universally accepted approach of measuring vulnerability, this study used outcome

[1]*To allow for non-food items and develop the general poverty line, the present study followed the procedure suggested by Ravallion and Bidani (1994) to calculate the nonfood poverty line. The study estimated the demand function for food by running a regression of food shares against a linear food poverty line as follow:*

a. $S_i = \alpha + \beta \log\left(\frac{Y_i}{Z^f}\right) + \varepsilon i$ *, where,* S_i *,* Y_i *and* Z^f *are food share of consumption, total consumption and food poverty live respectively.*

b. general poverty line for this study = $Z=Z^f(2-\hat{\alpha})$*=204 birr(2-0.78)=248.8*

approach of vulnerability measurement by adopting vulnerability as expected poverty method to analyze the determinants of vulnerability to poverty in the study areas. Chaudhuri (2001), Chaudhuri et.al (2002) and Bogale (2012) have also adopted vulnerability as expected poverty to measure the vulnerability of households to poverty.

In empirical research, the assessment of vulnerability to poverty requires panel data. But, for many developing countries, reliable panel data's are scarce and only cross-sectional survey data are available (Azam and Imai, 2009). Due to lack of panel data in developing country, assessing vulnerability to poverty became difficult. But, different scholars have tried to adopt different methodologies of measuring vulnerability. Among these, (Chaudhuri, et al., 2002: Ligon and Schechter, 2003: Bernd and Hermann, 2009: Dercon and Calvo, 2012) are some of the pioneering individuals in the field. Particularly, the works of (Chaudhuri et al., 2002) came up with a method of measuring vulnerability from a cross-sectional data. Accordingly, this study adopted the methodology proposed by Chaudhuri et al., (2002) by assuming vulnerability as Expected Poverty (VEP), an ex-ante measure. In this approach vulnerability is defined as the probability of being poor in the future. That means, the probability that a household that is currently not poor will fall below the poverty line or the probability that a household that is currently poor will remain poor.

Thus, this study followed Chaudhuri's suggestion and assume that all the cross - sectional variability of the crucial variable – percapita consumption, depends on the household's observable characteristics. In modeling vulnerability to poverty, first percapita consumption is regressed on the household's observable characteristics. This assumption allows the researcher to estimate vulnerability using cross - sectional data from a single point in time, thereby limiting data requirements.

Since the residuals that will be generated by this estimation may correlate to each other and exhibit different variances, the model is unable to capture all the systematic variability of the dependent variable (consumption). To address this, the researcher under takes a second step regression which involves estimating, via weighted least squares, a model of the residuals that explains their variability.

This second step gives the estimates of the residual variance. Lastly, the estimate of the variance of the residuals is used to calculate the probabilities that percapita consumption, which is assumed to be normally distributed, may be lower than an acceptable threshold, poverty line.

Suppose that the log of percapita consumption of each household is a function of a vector of characteristics such as household size, level of education, location, etc. So as to determine the effect of household charactertics and location charactertics on household consumption expenditures the approach of Chauduri, S. (2000), which has been widely used to generate vulnerability indices when single point consumption data are available and used. Suppose that the stochastic process for generating per capita consumption expenditure C_i for the i^{th} household is specified as

$$\boldsymbol{lnC_i = \alpha + X_i'\beta + u_i} \qquad (1)$$

Where C_i percapita kilocalorie consumption for the i^{th} household at a point of time while X_i represents a bundle of observable determinants of percapita consumption. The parameter β is a vector of coefficients of household characteristics to be estimated and u_i is a mean-zero disturbance term that captures idiosyncratic shocks that contribute to different percapita consumption levels. The consumption model in equation # (1) assumes that the disturbance terms has mean zero, but varies across households. Therefore the variance of the disturbance term violates the OLS assumption of constant variance (homoscedasticity) thus heteroscedastic, and it varies with the determinants of percapita consumption as follows.

$$\boldsymbol{\delta_i^2 = X_i'\gamma + \alpha + v_i} \qquad (2)$$

To account for heteroscedasticity in equation # 1 and get efficient estimates of β and γ, the researcher used a three-stage feasible generalized least squares (FGLS) method in estimating equation #1 and equation #2. First, the researcher estimated equation #1 using OLS to obtain estimated u_i and obtained its squared values as estimated variance δ_i^2 .In the second step, the variance obtained in the first step is regressed on the household socioeconomic characteristics and other charactertics as can be seen from equation # 2 using OLS. From this second estimation, the variance of δ_i^2 is estimated and used to avoid the problem of heteroscedasticity from equation # 1 as follow.

$$\frac{\delta_i^2}{\delta} = (\frac{X_i'}{\delta})\gamma + \alpha(\frac{1}{\delta}) + \frac{v_i}{\delta} \qquad (3)$$

Which can be written as

$$\delta_i^{*2} = X_i^*\gamma + \alpha * + v_i * \qquad (4)$$

The variances of equation #4 are homoscedastic and the estimated coefficients are now efficient and the variance obtained from equation # 4 is used to correct equation # 1 for heteroscedasticity and can be specify as follows.

$$lnC_i\left(\frac{1}{\delta*}\right) = \alpha\left(\frac{1}{\delta*}\right) + \beta'\left(\frac{X}{\delta*}\right) + \frac{u_i}{\delta*} \quad (5)$$

Equation #5 can be written as

$$lnC_i^* = \alpha^* + X_i^*\beta + u_i^* \quad (6)$$

2.5 The Logit Model for Determinants of Vulnerability to Poverty

Equation #6 is estimated using OLS and this gives us efficient estimates of the parameter **β**. We then generated the expected percapita consumption for each household by using equation#6. The expected percapita consumption thus generated are compared to the constructed poverty line (248 birr per month). Households whose predicted percapita consumption are less than the poverty line (248 birr per month) are classified as poor and those with predicted percapita consumption greater or equal to the poverty line are classified as poor. A dummy dependent variable is generated by giving 1 for poor and 0 for poor households in the study area. Then, a logistic regression model is estimated to generate Vulnerability as Expected Probability (VEP) of being poor in the future. This model gives us also the determinants of poverty in the study area.

$$ln\left(\frac{p(y_i=1)}{p(y_i=0)}\right) = ln\left(\frac{probability\ of\ poor}{probability\ of\ non-poor}\right) = X'\beta \quad (7)$$

Vulnerability as expected probability of being poor in the future can be estimated by the following equation,

$$VEP = pr(predicted\ percatita\ consumption < poverty\ line) = e^{X'\beta} \quad (8)$$

The ultimate outcome of our calculations is a set of estimates V_i (one for every household i) of the probability that each household faces of falling below the minimum percapita consumption requirement in the future. Each estimate takes values in the interval, [0, 1][1].

Since we can attach an index V_i to all households, the question arises which households should be considered vulnerable in between the two extremes. This is particularly important for the design on any mitigating interventions and associated policy formulation. It makes sense to consider households that have an estimated vulnerability close or equal to unity as "vulnerable" and those with a vulnerability index close or equal to zero as "non-vulnerable". But, as we move towards the center of the spectrum, the distinction becomes less obvious and the need for an arbitrary cut - off point arises. Among the many choices of cut - off points, the most commonly used one is 0.5 and the mean vulnerability which is equal with the observed poverty rate (0.298).

Finally, the researcher estimated the determinants of vulnerability by giving 1 for households with $V_i \geq 0.5$ and 0 for households with $V_i < 0.5$ using logistic regression model.

$$V = \alpha + X_i'\beta + V_i \quad (9)$$

Since the dependent variable is dichotomous, this model can be estimated using maximum likelihood estimation and can be specified as follow.

$$Pr\,(V = 1/Xi) = P_i = G\,(\beta 0 + \beta 1 Xi) = G\,(Zi) \quad (10)$$

Where G is a function taking on values strictly between 0 and 1. That means, 0≤ G (Zi) ≤1, for all real numbers Zi. This insures that the predicted probability (Pi) strictly lies between 0 and 1. For Logit model, G (Zi) is defined as follows:

$$G\,(Zi) = Pi = \frac{exp^{(Zi)}}{1+exp^{(Zi)}} = \frac{e^{Zi}}{1+e^{Zi}} = \frac{1}{1+e^{-Zi}} = \frac{1}{1+e^{-(\beta 0+\beta 1 Xi)}} = \frac{e^{(\beta 0+\beta 1 Xi)}}{1+e^{(\beta 0+\beta 1 Xi)}} \quad (11)$$

Therefore,

$$Pi = \frac{e^{Zi}}{1+e^{Zi}},\ where\quad Zi = \beta 0 + \beta 1 Xi. \quad (12)$$

If Pi is the probability of households being vulnerable and 1-Pi is the probability of households being non-vulnerable, the probability of being vulnerable and the probability of being non-vulnerable can be written as:

[1]*The extremes of the interval represent two opposite certainties: when $V_i = 0$, household will consume in the future with certainty at least the minimum amount of consumption prescribed by the threshold; when $V_i = 1$ household will consume less than the threshold (poverty line) in the future. In all intermediate cases, when $0 < V_i < 1$, no particular outcome is anticipated ex ante.*

$$Pi = \frac{e^{Zi}}{1+e^{Zi}} \quad (13)$$

$$1\text{-}Pi = \frac{1}{1+e^{Zi}} \quad (14)$$

Take the ratio of the probability of being vulnerable (Pi) and the probability of being non-vulnerable (1-Pi) and the resulting ratio is called odds ratio and can be written as:

$$\frac{Pi}{1-Pi} = \frac{\frac{e^{Zi}}{1+e^{Zi}}}{\frac{1}{1+e^{Zi}}} = e^{Zi} \quad (15)$$

Take the natural log of the above odds ratio and the resulting equation is called logit.

$$ln\left(\frac{Pi}{1-Pi}\right) = Li = Zi \quad (16)$$

$$Li = Zi = \beta 0 + \beta 1 Xi \quad (17)$$

Where, Li is called Logit which is linearly related with Xi and Xi is explanatory variables. Finally, an empirical model for the determinants of rural household vulnerability to poverty can be specified as follow:

$$Li = \beta 0 + \beta 1 AGE + \beta 2 FEMALE + \beta 3 EDUC + \beta 4 LANDSIZ + \beta 5 FS + \beta 6 DRKM + \beta 7 TLU + \beta 8 FY + \beta 9 TMRT + \beta 10 NFP + \beta 11 CREDIT + \beta 12 SNP + \beta 13 LD + Ui \quad (18)$$

Where, Li, AGE, FEMALE[1], EDUC, LANDSIZ, FS, DRKM, TLU, FY, TMRT and LD[2] stands for Logit, age of household head, dummy for gender, years of schooling, land size in hectare, family size, distance from all season roads in kilo meters, tropical life unit, farm income of household in Birr[3], time taken to reach the nearest market in minutes, non-farm participation of household, credit uses, participation in safety net program and dummy for location respectively. Regarding the expected sign of the parameters, off farm participation, years of schooling, land size, tropical life unit, farm income, participation in safety net program and uses of credit access are expected to reduce households vulnerability to poverty while distance from all season road, time taken to reach the nearest market and the dummy for gender are expected to increases the vulnerability of rural households to poverty in the study areas.

3. RESULTS AND DISCUSSION OF THE STUDY

This section presented the key outputs obtained from descriptive and econometric data analysis using data from 500 rural households in the study areas. To answer some objective of the study, descriptive ways of data analysis was used while Feasible Generalized Least Square (SGLS) method of econometric analysis was used to examine the determinants of vulnerability of rural households to poverty in the study areas following Chaudhri (2002).

3.1 Summaries of Households charactertics by level of Vulnerability

As can be evidenced from Table 1 below, the mean age of household head, family size, adult equivalent, distance from all season roads and distance form market\are higher for highly vulnerable households than less vulnerable households in the study areas. On the other hand, the mean annual farm income, years of schooling of households head, land size in hectares, tropical life units, frequency of extension visits and monthly expenditure per adult equivalent are higher for less vulnerable households than highly vulnerable households. This implies that vulnerability to rural poverty increases with an increase in age of house hold head, family size, and distance from roads and nearby markets.

As age of household head increases, productive household members who contribute to the income of their family may leave the households due to marriage or out migration and this may increase the vulnerability of households to poverty. Similarly, rural households will benefit from crop and livestock production via market participation and market participation by itself depends on distance from all season roads and nearby markets. So, as distance from roads and market increase, households' participation in input and output market decrease and this may increase the vulnerability of rural households to poverty.

The result clearly indicates that vulnerability to poverty increases with the increase in family size and adult equivalent. Relatively, age of the household is slightly higher for non-vulnerable households, showing the relative decline of vulnerability to poverty as age increases. In general we can conclude that vulnerability to

[1] *Gender dummy defined as 1 for female headed households and 0 for male headed households*
[2] *Location dummy defined as 1 Chencha District and 0 for Abaya District*
[3] *One UA Dollar=21 Ethiopian Birr*

poverty is high among households with large family size and high adult equivalent. Besides, rural households use livestock products (milk, butter and cheese) as their sources of food and they also get income by selling their livestock at a time of difficulty. Thus, more livestock population means, greater resilience to future poverty and this leads to negative relationships between vulnerability to poverty and the number of livestock owned by the households.

Table 1: Summaries of Continuous Variables of the Model by level of Vulnerability

Variables		Highly Vulnerable Households V>0.5		Less vulnerable Households V<0.5	
	Description of Variables	Mean	Std. Error	Mean	Std. Error
AGE	Age of household head	47.59	10.93	44.100	10.65
EDUC	Years of schooling	2.629	3.199	3.588	3.784
OFF_INC	Monthly Off farm income	652.1	1173.5	535.88	690.80
FARM_INC	Farm income (In Birr)	9792.	8040.5	10733.4	9631.8
FS	Family Size	7.986	2.561	5.7535	2.276
DPR	Dependency Ratio	0.387	0.1712	0.3985	0.2884
ADE	Adult Equivalent	6.857	2.1963	4.744	1.935
LS	Land Size (in ha)	0.767	0.6467	0.8433	0.7218
DRKM	Distance from Road in km	7.628	7.5518	1.123	1.151
DSMR	Time taken from market[1]	97.71	37.713	42.039	31.48
EXTN	Extension visits (Freq.)	24.04	32.250	35.5182	39.40
TLU	Tropical Life Units	2.331	1.7284	2.981	2.089
EXPND	Monthly Expenditure[2]	194.2	126.143	400.57	218.44

Source: Own Survey, 2016

The mean monthly income of highly vulnerable households are higher than that of less vulnerable households in the study areas and this may be due to the fact that, most participants in off farm activities in rural areas are poor households.

3.2 The Vulnerability incidence by some categorical variables

As can be evidenced from Table 2, female headed households appear to be more vulnerable to future poverty than their male headed households in the study areas. About 36% of female headed households are highly vulnerable to rural poverty while only 27.56% of male headed households are highly vulnerable to future poverty. Moreover, as Table 2 reveals, savers, credit users and users of safety net programs have greater resilience or lower vulnerability to future poverty in the study areas. For instance, about 17.6% of rural households in the study areas are users of safety net programs of which only 7.95% are vulnerable to poverty. In addition, about 53.2% and 42.3% of rural households have the experience of savings and credit uses respectively.

Table 2: The level of vulnerability of rural households to poverty by categorical variables

Level of vulnerability		Highly Vulnerable (V≥0.5)		Less Vulnerable (V<0.5)		Total	
Categorical Variables		Number	Percent	Number	Percent	Number	Percent
Female	Male	121	**27.56**	318	**72.44**	439	87.8
	Female	22	**36.06**	39	**69.93**	61	12.2
Credit	Users	5	**2.34**	208	**97.65**	213	42.3
	Non_Users	138	**48.08**	149	**51.91**	287	57.4
Savings	Savers	6	**2.25**	260	**97.74**	266	53.2
	Non_Savers	137	**58.54**	97	**41.45**	234	46.8
Safety Net Program	Users	7	**7.95**	81	**92.04**	88	17.6
	Non_Users	136	**33.01**	276	**66.99**	412	82.4

Source: Own survey, 2016

As can be noted from Table2, the descriptive analysis revealed that a considerable proportion of female headed households found to be vulnerable. This result is in line with the study conducted by Chaudhuri et al., (2002) in Indonesia who found that, households headed by female are more likely to be poor and vulnerable than male-headed households. Mohammed (2008) also found that higher fraction of female headed households is estimated to be highly vulnerable.

[1] *Time taken from the nearest market measured in minutes*
[2] *Monthly expenditure is given in per adult equivalent*

Credit uses by rural households, for example, through micro credit programs, might help poor households build up assets as it smoothes income and consumption. This implies that credit uses by rural households, who are mostly unbanked, can help them build resilience to future poverty as it enables the purchase of inputs and productive assets, and provides protection against shocks and this finding is in line with the study conducted by Ayalneh (2011).

3.3 Comparison of the vulnerability of Poor and non-poor households

To classify the rural households in the study areas as highly vulnerable, low vulnerable and not vulnerable depending on the predicted probability of being poor in the future, two vulnerability thresholds are used following Chaudhuri *et al*., (2002). These two thresholds are the average vulnerability which is equal to the poverty rate in the study areas (0.298) and 0.5. By using these two thresholds, households are classified as highly vulnerable if the predicted probability of being poor in the future (vulnerability level) is greater than 0.5, low vulnerable if the predicted probability of being poor in the future is between the average vulnerability (0.2980) and 0.5 and not vulnerable if the predicted probability of being poor in the future is less than the poverty rate or average vulnerability (0.298) in the study areas. As the result indicates, vulnerability to poverty is more widespread than poverty in the study areas.

Table 3 revealed that about 34.2% of the rural households in the study areas are vulnerable[1] and about 8.8% of the vulnerable rural households are not currently poor. That means, from the total non-poor households (351) about 6% are highly vulnerable to future poverty while 15.4% are less vulnerable to future poverty. This is why it is not sufficient to use current poverty status as a proxy for whether someone will be poor in the next period or not. It might seem surprising that about 4.4% of currently poor households are considered to be not vulnerable in this study. This means that these particular households are currently poor, but they are considered to have a relatively low chance of being poor in the next time period.

Table 3: Comparison of the level of vulnerability to poverty for poor and non-poor households

Poverty Status		**Level of Vulnerability to Rural Poverty**				
		Highly vulnerable	Low Vulnerable	Not Vulnerable	Total	
		$V \geq 0.5$	$0.298 \leq V \leq 0.5$	<0.298	Number	Percent
Poor	Number	122	5	22	**149**	**29.8**
	Within (%)	81.75	3.25	15.0		
	Over all (%)	24.4	1.0	4.4		
Non-Poor	Number	21	23	307	**351**	**70.2**
	Within (%)	6.0	7.0	87.0		
	Over all (%)	4.2	4.6	61.4		
Total	**Number**	**143**	**28**	**329**	**500**	**1000**
	Percent	**28.6**	**5.6**	**65.8**		

Source: Own Survey, 2016

As can be seen from Table 3, about 28.6% of the rural households in the study areas are highly vulnerable to poverty. From those who are highly vulnerable, 24.4% are currently poor while 4.2% of households are not currently poor. This implies that, poor rural households are relatively vulnerable to future poverty than currently non-poor households and this finding is in line with the study conducted by Dercon (2001).

In similar vein, 65.8% of the rural households in the study areas are non-vulnerable as can be evidenced from the Table 3. Moreover, from the total of non-vulnerable rural households in the study areas, about 61.4% are currently non-poor while 4.4% of non-vulnerable households are currently poor. Therefore, vulnerability analysis is very important for forward looking policy targeting than mere dependence on the ex-post poverty measure. As the study revealed, the proportion of vulnerable households (34.2%) is greater than the proportion of currently poor (29.8%) households in the study areas. In other words, vulnerability is more widespread than poverty in the study areas.

As presented in this study, the mean value of the vulnerability (probability of being poor in the near future) and the head count ratio or the ex-post measure of the extent of poverty in the study areas are the same, which is 29.8% as evidenced from Table 3. The households with vulnerability level of between the mean vulnerability (0.298) and 0.5 are categorized as low vulnerable households. Thus, according to the above descriptive statistics, about 5.6% of the households in the study areas have low vulnerability to poverty, of which 4.6% and 1% are currently non-poor and poor households respectively.

In this study, the poor constitute 29.8 percent of the population, but about 81 percent of those who are currently poor are highly vulnerable, 4 percent and 15percent are low vulnerable and not vulnerable respectively. To put differently, about 70.2% of the households in the study areas are not poor, of which 6%, 7% and 87% are

[1] *Vulnerable =low vulnerable plus highly vulnerable*

highly vulnerable, low vulnerable and not vulnerable respectively. Thus, poor household is almost 15 times as likely to be highly vulnerable to poverty as someone who is not currently poor. At first sight, this suggests that poverty predicts vulnerability quite well.

3.4 Econometric Data Analysis

3.4.1 Determinants of the Consumption of Rural Households (FGLS Model)

Following the Chaudhri method, the consumption model is estimated via the three steps Feasible Generalized Least Square (FGLS) which accounts for the problems heteroscedasticity in the consumption function. In order to project future consumption percapita, first the model of consumption percapita is estimated whereby consumption per capita is a function of a number of household characteristics. Since the residuals that will be generated by this estimation may correlate to each other and exhibit different variances, the model is unable to capture all the systematic variability of the dependent variable. In the second step, the squared residuals of the first model is regressed on all observable charactertics and the variances of this second model is determined. Finally, in the third steps, the variance which is obtained from the second equation is used to correct the first model of consumption percapita for heteroscedasticity.

The corrected consumption percapita is used to project the future consumption of households and those households whose predicted percapita consumption is below the minimum thresholds, 248 birr are considered as poor and those households whose future consumption percapita greater than the general poverty line, 248 birr, are considered as non-poor. Finally, the probability that the predicted consumption lies below the minimum expenditure requirements measures the vulnerability of households to poverty in the study areas. This predicted probability of being poor (vulnerability) is used to classify the households in to two, highly vulnerable households when the probability of being poor is greater than 0.5 and low vulnerable if the probability of being poor is less than 0.5.

Therefore, to examine the possible determinants of the vulnerability to poverty in the study areas, the vulnerability index is used to categorize households as highly vulnerable and low vulnerable. That means, if the vulnerability to poverty is greater or equal to 0.5, the household is categorized as high vulnerable which takes the value of 1 and 0 if the vulnerability index is less than 0.5 for the households. Then, this dummy variable is regressed on all explanatory variables of the model to determine the relative strength of each variable in affecting vulnerability (the probability of being poor in the future) using the logistic estimation.

As the three steps FGLS regression result reveals, age of household heads, family size, distance from all season roads in kilo meters and distance from nearest markets are negatively and statistically significantly related with the consumption per adult equivalent in the study areas. This result is in line with descriptive analysis and the prediction of economic theories. That means, as age of household head increases, active family members may leave the households due to marriage or rural out migration and this may decrease the income of the households and thereby their consumption. In the study areas where land resources are very scarce (average 0.5hectares), many children means, many mouths to the households' economy and this may reduce the percapita consumption of households. As can be seen from Table 4, the coefficient of family size is statistically significant at 1% level of significance and this shows that households with a large family size have a lower welfare than the households with a small family size. This result is in line with the finding of Jadotte (E. 2010).

Table 4: The Determinants of consumption per adult equivalent using FGLS method

LnC	Coefficient	Standard Error	Z-Value	Probability
AGE	-0.0035	0.0017	-2.02	0.04**
FEMALE	0.0975	0.0704	1.38	0.167
EDCU	-0.0019	0.0049	-0.39	0.697
NFP	-0.0376	0.0384	-0.98	0.328
FARM_INC	0.0157	0.0183	0.86	0.392
FAMILY SIZE	-0.0646	0.0064	-10.0	0.000***
LAND SIZE	0.0808	0.0262	3.00	0.002***
TLU	0.0300	0.0094	3.17	0.002***
CREDIT	0.1264	0.0366	3.45	0.0001***
SNP	0.1436	0.0387	3.70	0.000***
TMRKM	-0.0247	0.0050	-4.92	0.000***
TMRT	-0.0022	0.0004	-5.29	0.000***
LD	0.1222	0.0378	3.23	0.001***
CONSTANT	6.0451	0.1824	33.13	0.000
Total Observation = 500	R^2 =0.6439	Adusted R^2	=0.6290	
F(13, 484) =29.72				
Prob> F = 0.0000		VIF =1.33		

Sources: Own Survey, 2016

Note: *, ** and *** refers to level of significance at 10%, 5% and 1% level of significance.

Both the coefficients of the distance from all season roads in kilo meters (DRKM) and the time taken to reach the nearest market in minutes (TMRKT) are statistically significance at 1% level of significance. That mean, access to market and infrastructure (roads) affect the households output and input market participation by increasing transportation costs. As noted in Table 4, those households who are far from all season roads and markets have lower welfare (consumption per adult equivalent) than those households who are near to all season roads and local markets.

On the other hand, land size in hectare, tropical life units, credit uses and participation in safety net programs are positively and statistically significantly affect the welfare of rural households in the study areas at 1% level of significance. This implies that households with limited asset are more susceptible to vulnerability to future poverty. Thus, for those household with limited economic assets, it has a paramount importance to help them build up of assets through a combination of protective and promotional programs. Most of rural households are unbanked and therefore, access to financial services, for example, through micro credit programs, might help poor households build up assets as it smoothes income and consumption. The availability of credit services in rural areas may enable rural household's purchase of inputs and productive assets and this may increase the resilience of households to future poverty or any shocks.

As the regression result in Table 4 shows, households' participation in safety net program (SNP) increases their welfare (consumption per capita) in the study areas. Moreover, those households with larger land size in hectare have better welfare than those households with lower land holdings and this may be due to the fact that large land size enables the rural households to produce more crops and raise more livestock population which intern increases their consumption. The location dummy (LD) variable which assume 1 for households from Chencha woreda and 0 for households from Mirab Abaya Woreda is statistically significant at 1% level of significance. The coefficient is positive which shows that the consumption percapita of households in Chencha woreda statistically significantly higher than that of households in Mirab Abaya woreda at 1% level of significance. This may be due to the fact that, about 65% of Mirab Abaya woreda is low lands (semi-arid) and is also known by erratic rain fall pattern which makes this woreda more vulnerable to food insecurity. But, about 82% of Chencha Woreda is high lands with better distribution of rain fall compared to Mirab Abaya Woreda.

Regarding the diagnostic test of the above consumption model, there is no problem of heteroscedasticity as the three steps FGLS model accounts for this problem. As can be seen from Table 4 above, the test result for Multicollinearity revealed that the variance inflating factor (VIF) is below 10 which implies the non-existence of high correlation between explanatory variables. The overall test of significance of the above consumption model revealed that, about 64.39% (R^2) of the variation in consumption percapita is due to all explanatory variables included in the model. In addition to R^2, the other over all test of significance shows that, jointly all variables in the model statistically significantly affect consumption percapita at 1% level of significance in the study areas.

3.4.2 Determinants of Rural Households' Vulnerability to Poverty

Poverty alleviation is the main development agenda of developing countries in general and Sub Saharan African countries and South East Asian countries in particular. Many researchers and practitioners have been analyzing ex post poverty in developing countries mainly to measure the extent, gap and severity of the current poverty be disregarding the ex-ante which deals with the probability of being poor in the future which is very important for policy targeting. A person who is currently poor may become non-poor in the near future and similarly, a person who is non-poor currently may fall in to poverty in the near future. Therefore, poverty analysis for purpose of grouping a person as poor and non-poor and examining the determinants of poverty is not enough for anti-poverty policy interventions.

Therefore, for forward looking anti-poverty interventions, vulnerability analysis has a paramount importance in identifying not only the currently poor households, but also those households who are more likely to be poor in the near future. Thus, this study classified households in to highly vulnerable and low vulnerable using a thresholds of 0.5 and examined the determinants of vulnerability of rural households to poverty in the study areas using logistic regression. The dependent variable is a dummy variable which is obtained from the vulnerability level of each household estimated using 3 step FGLS. The dependent variable assumes value of 1 if the household's level of vulnerability to poverty is greater than or equal to 0.5 and 0 if the households level of vulnerability is less than 0.5. The logistic regression result of the determinants of vulnerability of rural households to poverty is presented in Table 5 Below.

The result of the logit estimation in Table 5 revealed that the coefficient of the age of head of household is positive and significant at 10%. That means, on average as the age of the household increases, vulnerability to poverty increases. This is because, as age of household head increases the ability of households to accumulate assets tends to decrease as some productive family members may leave the households due to mainly marriage and out migration from rural areas and this may increase the vulnerability of rural households to poverty and this result is in accordance with the finding of Mucarele (2001).

The coefficient of female is positive and statistically significant at 1% level of significance and this implies that female headed households are highly to future poverty than male headed households in the study areas.

Both the descriptive and econometric analysis show that female headed households are more vulnerable to poverty than male headed households. Hence the study suggests implications for gender policies. This may be due to the fact that female-headed households allocate their available resources in such a way as to obtain higher welfare than their counterpart male-headed households. The descriptive analysis in Table 2 revealed that, the probability of being highly vulnerable to poverty of female headed households is 36.06% while that of male headed households is 27.56%. Hence, as theory and empirics predict, female headed households are more vulnerability to future poverty than male headed households in the study areas and this finding is in agreement with the study conducted by Belyaneh (2004) and Sumarto, (2003).

The coefficient of years of schooling (level of education) assumed wrong sign, but it is statistically insignificant. This may imply that average years of schooling of households in the study areas is very low (about 3 years) and this level of education may not necessarily help rural households' to develop resilience to poverty by devising various strategies to build assets via diversification, market participation, technology adoption and … etc. The effect of education on vulnerability 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. Besides, family size, distance from all season roads in kilo meters and time taken to reach the nearest market in minutes positively and statistically significantly correlated with households vulnerability to poverty which is in line with the descriptive analysis presented in Table 1 above. This result is in agreement with the finding of Teshome (2010), Shiferaw (2003) and Frehiwot (2007).

Table 5:The Determinants of Vulnerability to Rural Poverty using Logit Model

Vulnerability (V)	Coefficient	Standard Error	Z-Value	Probability
AGE	0.0602	0.0374	1.61	0.107*
FEMALE	5.4207	1.3573	3.99	0.000***
EDCU	0.0210	0.1528	0.140	0.891
NFP	1.8764	0.9005	2.08	0.037**
FARM_INC	-0.0001	0.0001	-1.91	0.056**
FAMILY SIZE	1.6735	0.3344	5.00	0.000***
LAND SIZE	-2.0153	0.9249	-2.18	0.029**
TLU	-1.1399	0.2664	-4.28	0.000***
CREDIT	-6.4583	1.6967	-3.81	0.000***
SNP	-0.9607	1.6066	-0.60	0.550
DRKM	1.4938	0.3756	3.98	0.000***
TMRT	0.0919	0.0205	4.47	0.000***
LD	0.6409	1.3061	0.49	0.624
CONSTANT	-21.0137	4.3953	-4.78	0.000
Total Observation = 500	Wald Chi_square =60.51			
Pseudo R^2 =0.48	Prob> Chi _square =0.0000	VIF =1.33		

Source: Own Survey, 2016

Note: *, ** and *** refers to level of significance at 10%, 5% and 1% level of significance.

The coefficient of family size has positive sign and statistically significant at 1% level of significance as can be evidenced from Table 5.This implies that large family size exerts more pressure on consumption than its contribution to income generation in the study areas. Therefore, according to the present study as family size increases, the probability of falling in to poverty in the future or vulnerability to poverty increases significantly. This result is in line with the study conducted by Jadotte E. (2010) and JHA, R(2009). In agrarian economy, rural farm households will benefit from their crops and livestock productions via market participation and market participation by rural farm households depend on distance from the roads and markets. Thus, the study revealed that as distance from the road and market increases, rural household's vulnerability to poverty increases and therefore, infrastructural provision and market development in rural economy may help the poor build resilience to poverty and food insecurity.

More importantly, land size, annual farm income, tropical life units, credit uses and participation in safety net programs statistically significantly reduce the vulnerability of rural households to poverty in the study areas. Those households with more annual farm income have greater resilience or lower vulnerability to poverty or food insecurity and the coefficient of annual farm income is statistically significant at 5% level of significance as indicated in Table 5.

The estimation result revealed that those households with limited assets (land holdings & livestock population) have lower resilience or higher vulnerability to future poverty in rural areas and this finding is in line with the study conducted by Mesfin (2011). Thus, for those household with limited land holdings and livestock

population, government has to design anti-poverty strategies such as micro and small enterprise development and promotion of non-farm activities in rural areas to help those disadvantaged group (female, land less households and youth) to build their assets. Most of rural households are unbanked and therefore, access to financial services in rural areas may enable rural household's participation in non-farm activities, purchase of inputs and productive assets and this will increase the resilience of rural households to future poverty and the study by Ayalneh (2012) revealed the same result.

Finally, the diagnostic test results of the logit model shows that there is no problem of Multicollinearity as the mean value of variance inflating factor (VIF) is 1.33 which is less than 10. The Wald test which can be used to test the overall significance of the model revealed that all variables included in the model are jointly statistically significant at 1% level of significance.

4. Conclusion and Recommendation

So far, many researchers or practitioners have ignored vulnerability analysis as an important and necessary component to poverty in poverty analysis. But, it has gained important attention in recent times as a result of its crucial contribution to policy making. Poverty assessment studies have been heavily used for policy purposes. However, such kind of studies provide only an expost measure of household's wellbeing as an input for poverty reduction strategies. However, they do not provide us a tool for a priori prevention of poverty incidences as a result of unforeseen risks. Hence, vulnerability studies complement poverty studies by providing an ex ante measure of wellbeing.

In this study attempts are made to study the vulnerability of rural households to poverty and its determinants are examined using three step Feasible Generalized Least Square and the logit models respectively. In general, chronic poverty is predominant in the study areas (24.2%), that means, many of the households in both Woredas are poor and vulnerable to poverty using 29.8% and 50% as observed poverty rate and vulnerability threshold respectively. Thus, programs targeting on poverty should primarily focus on factors causing persistence deprivation. This essentially requires supporting households to accumulate assets by investing on projects that create employment and enhance their livelihoods besides improving their access to services such credit, training, inputs and better technologies.

The general poverty line of the study area was determined to be Birr 248 per month per adult equivalent and 29.8 percent of the population in the study areas were found to be poor. The projected consumption percapita after the three step FGLS estimation revealed that, the incidence of vulnerability to poverty in the area was 34.2 percent and therefore, vulnerability was more spread in the study areas than ex post poverty.

Using the two vulnerability thresholds, observed poverty rate (0.298) and vulnerability of 0.5, about 28.6%, 5.6% and 65.8% of households were highly vulnerable, low vulnerable and not vulnerable respectively. Most importantly, from the total poor households about 81.75%, 3.25% and 15% were highly vulnerable, low vulnerable and not vulnerable respectively. About 36.06% of female headed households were highly vulnerable while 27.56% of male headed households were highly vulnerable.

As can be seen from the key findings of the present study, some households who are currently poor are found to be not vulnerable while other households who are currently non-poor are also found to be highly vulnerable to falling into poverty in the future. This has a paramount importance for policy implications and therefore vulnerability analysis should be taken into account, particularly when policy makers design anti-poverty policies. Thus, ex-ante measures should be used to prevent households from becoming poor while ex-post measures of poverty has to be used to alleviate those households who are already in poverty.

In the study areas, households with limited resources (small land holdings and livestock population), large family size, limited access to market and roads and female headed households are vulnerability to falling in to future poverty. According to the results of this study, vulnerable non-poor households are most likely to benefit from some combination of prevention, protection, and promotion which would give them a more secure base to diversify their activity into higher return activities.

Rural farm households access to markets, roads, credit and off-farm activities are found to be more important in reducing vulnerability to future poverty. But, in the study areas, infrastructures and rural markets are poorly developed which prevents households from both inputs and output market participation. Similarly, most rural population are unbanked and therefore, there is limited access to finance or credit which may help the rural households to purchase inputs, participate in off farm activities and adopt new technologies.

Therefore, strategies aimed at reducing poverty should critically consider factors that make households vulnerable to poverty. Based on the key determinants of vulnerability of rural households to future poverty, some of the key policy variables in the study areas are provisions of credit services, population policies such as family planning to reduce family sizes of households, developments of rural infrastructures and markets and promotion of non-farm participation of rural farm households via micro and small enterprise developments to build their resilience to future poverty via asset accumulation.

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