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Determinants of Vulnerability to Poverty in Amhara Region, Ethiopia: Evidences from Rural Households of Gubalafto Woreda

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Abstract
People in Amhara Regional State, particularly rural population in Gubalafto Woreda safer from man-made problems and environmental distractions. Households in the study area were suffered from a successive food deficit and famine, and large numbers of residents were vulnerable to poverty in the last ten years. Per year, around 35 percent of the total population survives and depends on emergency relief food aid in the last two-consecutive years. The study was set out to examine the extent and determinants of vulnerability to poverty in the study area and to identify the major shocks that the households were encountered. Primary data was collected from the stratified random sample of 250 households undertaken from three agro-ecological zones to achieve the research objectives using cross-sectional observation. This study revealed that, 37.42 percent of sample household being under poverty at a period ahead. Only 30.8 percents of sample households were unable to deserve their basic needs at a current time in the first parts of the paper. However, after a year, large number of people those who are currently non-poor becomes poorer. The OLS and 3FGLS analytical model used to assesses the determinants of vulnerability to poverty. Consequently, family size, participation on wage employment, distance to the main market and kolla agroecological dummy affect vulnerability to poverty positively. On the other hand, oxen, land size, non-livestock asset, participation on own business, access to credit and access to extension service affects vulnerability to poverty negatively and significantly. Moreover, village level infrastructural facility has an effect on household vulnerability to poverty negatively and significantly. At the end, rural household vulnerability to poverty closely linked with demographic characteristics, asset holding, infrastructural facilities, and institutional services.
Keywords: Vulnerability to Poverty, Determinants, Rural Household, Northern Amhara, Ethiopia.

1. INTRODUCTION

Even though, different institutional and structural reforms were undertaken, rural household's vulnerability to poverty had been prevalence in Sub-Saharan African countries for the last three decades in which Ethiopia is the most affected one. As a result, the Ethiopian government has introduced agricultural development lead industrialization policy as its main policy program accompanied with many poor targeting interventions to achieve sustainable economic growth and reduce poverty and vulnerability to poverty. Government has been constantly pursuing development efforts in addressing mainly rural poverty and vulnerability. Most policy interventions adopted by sub-Saharan African countries have however only focused on poverty at a point in time. However, still now it remains one of the world's poorest countries, and large numbers of its residents are vulnerable to poverty.

Most policy interventions adopted by sub-Saharan African countries have however only focused on poverty at a point in time. Nevertheless, poverty as a vulnerability concept is now considered as a dynamic progression, which allows for putting in place appropriate proactive interventions to address poverty. Poor people are more vulnerable to any shock (health hazards, economic downturns, natural catastrophes and man-made violence) as compared to other group (Philip and Rayhan, 2004). People universally face risks and vulnerabilities but poor people, especially those living in rural areas depends on agriculture and in tropical ecologies face more than others do. Widely this is true in a large proportion of sub-Saharan Africa's (SSA's) population.

According to Handley et al (2009), several numbers of risks and vulnerabilities derive and maintain poverty in SSA. Mostly it includes natural hazards, which brings the harvest failure, imperfect market that cases the market failure and volatility, conflict, and health related shocks. Dercon and Krishnan (2000) reported that rainfall shocks, crop damage and livestock diseases are among the leading shock that make households vulnerable to poverty in rural Ethiopia. Another study considered that Ethiopia is a shock-prone country, almost all surveyed households reports being negatively affected by shocks between 1999 and 2004 particularly drought shocks and illness shocks are the most important shocks. Dercon and Hoddinott (2005) found that more than 50 percent of their surveyed households reported drought as the most important shock. The authors were able to show that experiencing a drought at least once during the five-year study period lowered per capita consumption by about 20 percent. There is an extreme vulnerability, with the household consumption rising and falling dramatically from year to year resulting from drought, illness of household head, or other family health and death shocks. As a result, many families who are not currently poor are at constant risk of falling into poverty, and can never build up adequate amount of assets to get out of poverty. In many developing countries, policies aimed at improving welfare through poverty reduction tend to target the current poor to the neglect of the most vulnerable. An understanding of household susceptibility to future poverty will be crucial for sustainable growth and development. Hence, any

policy directed towards poverty reduction is required to take into account the vulnerability of current non-poor households (Novignon, 2010).

At the same time, vulnerability also strongly related to environment, climatic, and other natural disasters that hit rural household widely and its effects spread into the entire population (rural and urban). Tsehay and Bauer (2012) examine the dynamics and determinants of rural household poverty and vulnerability in the Northern highlands of Ethiopia using Ethiopian household survey data 1994-2010. They found that in the panel period, poverty indices significantly varies over time and across the districts that it shows different causes may account for the household either being poor or not, including Landholding, access to credit and agricultural extension services , family size. However, this study did not included infrastructural and environmental variables comprehensively. In previous study, the impact of infrastructural and environmental factor was not displayed in the analysis of poverty and vulnerability to poverty.

There were many evidences that the large number of rural households in this region as well as particularly in the study areas were under poverty and being in poverty over a period ahead.

Firstly, even if, the total as well as food poverty decline in all regions over the past five years, food poverty increases from 32.5% in 1999/00 to 38.8% in 2004/5 to 42.6% in 2010/11 consecutively in Amhara regional state where Gubalafto Woreda is found (MOFED, 2012). Hence, large number of currently non-poor households had been vulnerable to poverty in a period ahead.

Secondly, the rural population in the study area has suffered from a successive food deficit and famine. These have been aggravated by drought, land degradation, moisture deficit and decline in landholding caused by rapid population growth. To this end, around 37% of the Woreda populations were targeted by PSNP program for the next five years (MoARD, 2009). So that, from time to time, currently non- poor households may be being in poverty in a period ahead.

Lastly, according to the office of North Wollo food security and disaster prevention and preparedness report 2012, around 35 percent of total population had been an emergency relief food aid recipient in the last two consecutive years in the study area.

Therefore, the study designed to fill the existing gaps, and come up the solutions for the existing practical problems.

2. Research objectives

The general objective of this study is to analyze the rural household's vulnerability to poverty in the study area. As part of the general objective, this research work intends to achieve the following specific objectives as well:

- To measure the extent of vulnerability to poverty in the study area
- To identify the major determinants of vulnerability to poverty
- To identify the major shocks that the rural households faces

3. Methodology

3.1. Description Of Study Area

This study was carried out in Gubalafto Woreda, which is found in Amhara regional state, Ethiopia. The area is divided into three agro-ecological zone; highland (ranges from 2300-3300masl), mid-latitude (ranges from 1900-2200masl) and lowland (ranges from 1500-1800masl). Concerning the agro-ecological distribution of the study area; lowland, mid-attitude and highland were shared by 17 percent, 46 percent and 37 percents respectively. Only 36.59 percent of land size is suitable for cultivation. The largest land holding size for a household is 0.78 hectare, which is ranging from 0.4 hectare in the highland areas to the 1.93 hectare in the lowland. The area is highly drought prone and faces shortage of rainfall. On average, it receives between 300-400mm rainfalls per year.

3.2. The type & sources of Data

The study used mainly primary data collected at household level. Multipurpose structured questionnaire was used to collect the household data regarding to household demographic composition, consumption expenditure income, livestock holding, educational level, idiosyncratic and covariate shocks that. The data collection process was held through a personal interview with the households on March 2013.

3.3. Sampling Techniques

This study uses multistage sampling procedure to get representative sample households. First, the total number of Kebeles stratified into three agroecologocal zones such as highland, mid-attitude and lowland. Second, considering the number of explanatory variables, only 250 sample households were undertaken from the target population, and proportionately distributed across the three agro-ecological zones. Finally, sample household were selected using systematic random sampling methods, which is sampling draw of every n^{th} element from a list.

3.4. Econometric model specification: Vulnerability to Poverty and its Determinants

Poverty analysis provides only an ex-post measure of household's welfare as an input for poverty reduction strategies. However, such kinds of studies do not provide a tool for a priori prevention of poverty incidence because of unexpected contingencies. Therefore, the story of poverty measurement and analysis never stops here. Even if they are different concepts, economists argue that there is strong integration between poverty and vulnerability to poverty for two reputable facts: (i) the poor typically exposes to diverse risks, and (ii) the poor has the smallest capability to deal with these risks. In general today's poor may or may not be tomorrow's poor and currently non-poor households, who faces a high probability of adverse shock may experience the shock and become poor tomorrow (Azam and Imai, 2009; Chaudhuri, 2003; Dacron, 2005). We used Vulnerability as expected poverty (VEP) approach proposed by (Chaudhuri, 2003), Chaudhuri et al, 2002) for cross-section data in terms of its advantages to identify households exposed to risks but who are not poor. In this approach for a given household h, the vulnerability to poverty at current time defined as the probability of a household's per adult consumption expenditure being below the poverty line at time t+1:

$$V_{ht} = \mathrm{pr}(\ln C_{ht+1} < lnZ \mid X_h, Z) \quad (1)$$

Where, is household 'h' vulnerability to poverty at time t, measures the household's per adult equivalent consumption expenditure at a time t+1, and refers to an appropriate poverty line. The probability that a household falls into poverty depends on its expected (mean) consumption and its volatility (i.e., variance from an inter-temporal perspective) of its consumption stream. Assuming that for household h the data generation process for consumption captures in the following equation:

$$\ln C_h = \beta X_h + \varepsilon_h \quad (2)$$

Where, per capita consumption expenditure for household h, denotes vector of observable household characteristics and other determinants, is a vector of parameters, is a mean-zero disturbance term that captures unobserved factors (shocks) that would have affected households' consumption and assumed to be normally distributed. Besides, households future consumption will further assumed to be depends upon uncertainty about some idiosyncratic and community characteristics. Assuming constant variance of the disturbance term means that the household has a constant variance in the log consumption and then it contradicts to the existing reality and empirical evidence since poor households have more variation in consumption as compared to non-poor in most cases. Hence, in order to have a consistent estimate of parameters, it is necessary to allow heteroscedasticity, allowing variances of the disturbance term to vary, such that the variance of term varies across time as the explanatory variables vary in some parametric way and expressed as:

$$\sigma^2_{e,hh} = Z_h\theta + \eta_h \quad (3)$$

A three-stage feasible least squares (FGLS) procedure used to estimate. Here, equation (2), is first estimated using the ordinary least squares (OLS) procedure. Next, the estimated residuals from Equation (2) then used to estimate the following equation by OLS.

$$\hat{e}^2_{ehols} = Z_h\theta + \eta_h \quad (4)$$

The estimates (predicted values) from equation (3) which $Z_h\hat{\theta}$ is used to transform equation (4) as follows:

$$\frac{\hat{e}^2_{ehols}}{Z_h\hat{\theta}} = \left(\frac{Z_h}{Z_h\hat{\theta}}\right)\theta + \frac{\eta_h}{Z_h\hat{\theta}} \quad (5)$$

Then, this transformed equation also estimated by using OLS to obtain an asymptotically efficient FGLS estimate, $\hat{\theta}_{FGLS}$. $Zh\hat{\theta}_{FGLS}$ is a consistent estimate of $\sigma^2_{e,hh}$.

The variance of the idiosyncratic component of household consumption used to transform equation (2) as follows:

$$\frac{\ln C_h}{\sqrt{Zh\hat{\theta}_{FGLS}}} = \left(\frac{X_h}{\sqrt{Zh\hat{\theta}_{FGLS}}}\right)\beta + \frac{\varepsilon_h}{\sqrt{Zh\hat{\theta}_{FGLS}}} \quad (6)$$

OLS estimation of the equation (5) gives a consistent and asymptotically efficient estimate of β, $\hat{\beta}_{FGLS}$. Then, estimated parameters β and θ that is obtained through three-step Feasible Generalized Least Squares (3FGLS) procedure ($\hat{\beta}$and $\hat{\theta}$) are used to estimate the expected log consumption and variance of log consumption for each household by:

$$\widehat{E}\ (\ln C_h|x) = \hat{\beta}X_h, \quad (7) \quad \text{and}$$

$$\hat{V}\ (\ln C_h|x) = \hat{\sigma}^2{}_{eh} = \hat{\theta}Z_h \quad (8)$$

Consequently, vulnerability level of household h which is the probability of that household h with characteristics X_h will be poor in the future would be estimated by assuming that households' consumption expenditures are log normally distributed, that is, vulnerability probability computed as:

$$\hat{V}_h = \widehat{Pr}(\ln C_h < lnZ\ |X_h) = \Phi\left(\frac{\ln Z - X_h\hat{\beta}}{\sqrt{\hat{\theta}Z_h}}\right) \quad (9)$$

Estimated vulnerability to poverty depends on the distributional assumption of normality of log consumption, the choice Z, the expected level of log consumption and variability of log consumption.

In addition to this, the determinants of vulnerability to poverty will assess using ordinary least squares following Azam & Imai (2009). Thus, the model below applies to examine the idiosyncratic and covariant determinants of vulnerability to poverty of each household in the study area.

$$\widehat{V_h} = \pi X_h + \mu_h \quad (10)$$

Where, $\widehat{V_h}$ is the estimated vulnerability of each household, X_h Is the vector of household idiosyncratic and covariant characteristics captured from household surveys, π is a vector of coefficients, μ_h is the error term.

4. RESULTS AND DISCUSSION

4.1. The Extent and Determinants of Vulnerability to Poverty

Considering the estimated vulnerability to poverty of the households, on average 37.42% households are vulnerable to poverty. It implies that there is a probability of around 0.37 of falling into poverty in a period ahead that is the head count poverty index in the next period. In line with Chaudhuri (2003), adopting the focal point to be 0.5 where the household becomes vulnerable to poverty (those who have an estimated vulnerability level greater than or equal to 0.5), 35.08 % of the households found vulnerable to poverty. Like the extents of poverty decomposition by the gender of household head, decomposition of vulnerability to poverty does not show a significant difference between male and female-headed households.

The determinants of vulnerability to poverty estimated using the level regression (see Table 1). Accordingly, the coefficient of the age of household head has a negative and significant effect on the household's vulnerability to poverty, and it is statistically significant at 1% significance level. This indicates that the household's vulnerability to poverty decrease as the age of household head increase. This is due to the reason that as the age of the household head increase the household acquire more skill and experience about the farming activities, and accumulated assets that used to alleviate the household's vulnerability to poverty.

Table 1: Determinants of Vulnerability to Poverty (OLS Regression)

Explanatory variables	Coefficient	Robust.Std. Err	t- value	p-value
Head male	0.0693**	0.0314	2.20	0.029
Head age	-0.0475***	0.0047	-10.11	0.000
Age square	0.0004***	0.0000	9.53	0.000
Mean family age	-0.0035**	0.0016	-2.11	0.036
Family size	0.0208*	0.0114	1.83	0.068
Number of child, 7-14years	0.0856***	0.0312	2.74	0.007
Dependency ratio	0.1373**	0.0606	2.27	0.024
Headedu8(>=primary school)	-0.0270	0.0209	-1.29	0.198
Oxen per adult equivalent hh	-0.0343***	0.0108	-3.19	0.002
Tlu per adult equivalent hh	0.0329	0.0270	1.22	0.223
Land size per adult equivalent hh	0.0403	0.0293	1.38	0.169
Current asset value	0.0000***	0.0000	-4.95	0.000
Employment on own business	-0.0499***	0.0189	-2.64	0.009
Employment on wage	0.0130	0.0169	0.77	0.443
Irrigation access	0.0178	0.0182	0.98	0.330
Access to credit	-0.0747***	0.0175	-4.26	0.000
Access to extension services	-0.0485**	0.0238	-2.04	0.043
Input use	-0.0161	0.0271	-0.59	0.553
Access to aid	-0.0028	0.0183	-0.15	0.877
Village level infrastructural index	-0.1178***	0.0409	-2.88	0.004
Distance to main market	0.0003***	0.0001	3.30	0.001
Drought shock	-0.0047	0.0210	-0.22	0.824
Livestock shock	0.0048	0.0132	0.37	0.715
Dega	0.0344	0.0374	0.92	0.359
Kolla	0.0976***	0.0281	3.48	0.001
_cons	1.4066***	0.1302	10.80	0.000
Number of obs = 248	F(25, 222) = 65.28	Prob > F = 0.0000		
R-squared = 0.8543	Root MSE = .10808			

///*, ** and *** refers to Significant at 10%, 5% and 1% Significant level respectively

Source: Compute from own survey, 2013

Age square of the household head is positively, and significantly correlated to the vulnerability to poverty and statistically significant at 1% significance level. Consistent with the lifecycle effects, the age of the household head and its squared are negatively and positively correlated to the vulnerability to poverty respectively. This is similar with the result of Yesuf (2007).

The coefficient of dependency ratio and the number of juniors has a positive and significant impact on the household's vulnerability to poverty. This implies that the households with a large number of household members under the age of 14 years and above 64 years have a higher level of vulnerability to poverty. This is due to the fact that, the larger number of dependents in a household increase the burden on the active household members in meeting cost of minimum basic need requirements (food and non-food), thereby it increases the chance of vulnerability to poverty of that household. This is similar with the finding of (Azam & Imai, 2009).

Oxen holding and current value of non- livestock asset holdings are negatively and significantly associated with the household's vulnerability to poverty status. The households with a large number of oxen and having a large value of assets have a lower level of vulnerability to poverty as compared to the households with less number of oxen and less value of the current asset holding. The current value of the household asset holding measures the potential of the household to acquire the required inputs and to withstand economic shocks and income shortfalls to finance the household needs.

The finding shows that, the coefficient of household involvement in own business activities, access to credit and access to agricultural extension services influenced the household's vulnerability to poverty negatively and in a significant manners. Agricultural activities are highly vulnerable to the environmental shocks such as drought, flood, snow and hail storm and crop disease. Hence, one way to minimize household's vulnerability to poverty is the households' ability to get access to non-farm income opportunities. This study found that households with access to employment on own business activities are more secure and less vulnerable to poverty than households without income from own business. Households with access to credit are less vulnerable to poverty than households without access to credit. This is true since, access to credit minimizes a household's financial constraint to acquire inputs and enough productive resources, which enables them to have diversified income sources and hence lower level of vulnerability to poverty. This result is in conformity with the findings by Tsehay & Bauer (2012). Access to agricultural extension services reduces households' vulnerability to poverty implying the fact

that extension services provide inputs and build up farmers' skills to use recommended amount of seed and fertilizer, to diversify their crops, which leads to minimize the effect of environmental shocks like crop diseases. Female-headed households become less vulnerable as compared to the male-headed households. This might be due the reasons that, in the study area female-headed households are mostly sharecropped out their land and received some amount of money before harvest. It may help them to have more or less secure income although they sacrifice a certain amount of their farm income. However, it needs further study.

The variable, infrastructural index has entered in the regression analysis as a composite index of village level access to the following facilities: primary school, secondary school, access to clinic, access to hospital, access to pharmacy, veterinary services, public phone, electricity, grain mill, all weather roads and nurse site. The coefficient of the village level infrastructure index has a negative and significant effect on the household's vulnerability to poverty similar with the finding of (Novignon, 2010). The significance of the infrastructure index indicates that those households who have enough access to various infrastructural facilities tend to increase their welfare, hence reduced vulnerability to poverty. The coefficient of the remoteness to the main market and agroecological dummy are statistically significant at the 1 % significance level and having positive impacts on the household's vulnerability to poverty. The result of agroecological dummy and access to main market shows the similar pattern for poverty and vulnerability.

4.2. Shocks and its Coping Strategies

Around 86% of the surveyed households have reported drought shock followed by flood and soil erosion (62.8%) was the most frequently occurring environmental shocks over the last five years (see Table 2). This implies that consistent with other findings (see for e.g. Temesgen, 2010; Decone, 2005) drought is the dominant form of shock in Ethiopia.

Table 2: Major shocks encountered by the households in Gubalafto Woreda

Types of Shock	Number of households	Percentage of households
Drought shocks	215	86.00
Flood and soil erosion	157	62.80
Hail storms	112	44.80
Crop diseases and pests	137	54.80
Livestock diseases and pests	49	19.60
Death shocks	16	6.40
Illness shock	90	36.00

Source: Compute from own survey, 2013

The survey households (see Table 3) reported the effect of shocks on their consumption, income and productive assets. Around 83.2%, 47.6% and 69.2% of respondents were reporting that their farm income, productive asset holding and the household consumption decrease because of drought shock in the study area respectively. Household's productive asset holding decrease by an adverse effect of the most commonly repeated shocks either directly or indirectly. Some shocks like livestock disease and drought directly killing the livestocks in one way and it also forced the households to sell their livestock and other productive asset to subsidize their consumption short falls in the other way. Hailstorm, pests and crop diseases directly reduced crop and non-crop farm income and subsequently it reinforced the households to reduce their livestock and other productive asset holding which affects their future income generating ability. In general, the impact of a particular shock is not limited to the household's asset holding, income or consumption. For example, drought shock affects household consumption through its effect on income and subsequently it affects the household's productive asset holding.

Table 1.6: The effect of shocks on the surveyed households

Types of shocks	Effect of shocks on surveyed households	Number farmers	Percentage
Drought shocks	1. Loss of productive assets	119	47.60
	2. Loss of household income	208	83.20
	3. Reduction in household consumption	173	69.20
Flood and soil erosion	1. Loss of productive assets	57	22.80
	2. Loss of household income	152	60.80
	3. Reduction in household consumption	125	50.00
Hailstorms	1. Loss of productive assets	50	20.00
	2. Loss of household income	152	60.80
	3. Reduction in household consumption	125	50.00
Crop disease and pest sides	1. Loss of productive assets	63	25.20
	2. Loss of household income	131	52.40
	3. Reduction in household consumption	120	48.00
Livestock shocks	1. Loss of productive assets	35	14.00
	2. Loss of household income	46	18.40
	3. Reduction in household consumption	39	15.60
Illness shocks	1. Loss of productive assets	69	27.60
	2. Loss of household income	86	34.40
	3. Reduction in household consumption	57	22.80

Source: Compute from own survey, 2013

Respondents mentioned different alternative methods that used to overcome consumption shortfalls and cope up themselves from different shocks. Accordingly, reduction of consumption in terms of both the number of meals per day and amount of food per meal was identified as a means of coping mechanism for the largest proportion (58.8%) of the respondents. The second frequently used strategy reported by 48.8% of the respondents (households) was sale of livestock. Emergency relief in the form of food aid from government and NGOs reported by 38% of the households stands as the third frequently used coping mechanism.

Conclusion and Policy Implication

Even if, various food security programs such as safety net program, rural household's agricultural extension services and credit access were implemented widely, large number of people had been vulnerable to poverty and currently non-poor becomes poor in a period ahead.

Vulnerability to poverty deeply correlated with household characteristics. The econometric results show that, large family size, higher dependency ratio, and more number of children are significantly aggravating people to be vulnerable to poverty. Therefore, serious attention has to be given to limit the increasing population in the study area.

Factors like number of ox per adult and current value of asset holding (both farm and household asset) found negatively correlated with the household's vulnerability to poverty. Therefore, this is an insight that rural household asset bulling program should be implemented to reduce households vulnerability to poverty.

Infrastructural facilities especially the transportation system is not well developed and particularly the households in the Dega agroecological zone supposed to traveled more than 41Kms to access transportation services. Therefore, policy measures required for creating and expanding the self-employment opportunities accompanied with strengthening the transportation facilities.

Moreover, public services such as access to credit and agricultural extension services significantly affect household's vulnerability to poverty with the expected signs. Therefore, expanding rural credits and agricultural extension services to subsistence farmers should be one of the main areas of intervention and policy options.

In the last, the regression results revealed the households in the remote areas are also highly vulnerable to poverty. This calls the policy measures to address inadequate market access through investments in marketing infrastructures, such as market stalls, rural access roads, transportation facilities and agricultural price information systems. Moreover, the private sector and NGO's should be encouraged to invest in agricultural input and output market infrastructural facilities. The coefficient of the village level infrastructural facility has a significant and negative effect on the household vulnerability to poverty. Village level infrastructural facilities contributed to the households to have a diversified and a stable source of income, and hence it reduced the household's vulnerability to poverty. This calls the policy measures to alleviate the rural household vulnerability to poverty through investment in the infrastructural facilities.

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