

Assessing Households Vulnerability to Poverty in Ethiopia: Estimates from Sedentary Areas of Afar Region: Ethiopia

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Abstract

During analysis of vulnerability to poverty across time there is a chance that a household that is not poor becomes poor, one that is poor remains poor. This leads to vulnerability assessment in terms of 'vulnerability to poverty'. 'Vulnerability to poverty' is the probability that a household will be poor next period. So it is an important concept to deepen the understanding of poverty, since it reveals information on what measures should be taken to prevent poverty while poverty dynamics largely imply the past and contemporary poverty situation and is helpful on how to alleviate the existing situation

Using four round HCIS survey panel data for the years 2004, 2008, 2011 and 2014, collected by central statistics authority of Ethiopia, this thesis examined vulnerability to poverty of rural households in Afar region: Ethiopia. It also analyzed correlates of vulnerability to poverty. Using Stratified random sample of 360 households was drawn from sedentary zones of Afar region.

To estimate the vulnerability to poverty of a household the researcher adopted the vulnerability measure in Chaudhuri (2003). In order to estimate this measure the researcher followed a three step Feasible Generalized Least Squares (FGLS) to estimate the expected log per adult equivalent consumption expenditure. Using these estimates and assuming that per adult equivalent consumption expenditure is log normally distributed the researcher estimated the vulnerability measure as the probability that the standard normal variate will fall below standardized poverty line. Thus, using the GLS estimates determinants of vulnerability was analyzed using OLS method and later on logit model for comparison.

The finding shows that there is high vulnerability to poverty, i.e. high probability of becoming poor in a period ahead, in the region and it is significantly and negatively correlated with household head age, agricultural extension services, land fertility use of improved seeds, irrigation, off farm income, farm size, TLU but positively correlated with household age squared, dependency ratio and family size.

Introduction

Poverty is a universal phenomenon, challenging various government and non-government officials who are separate of achieving development. According to the world development report, about 1.2 billion people in the world live on less than \$1 a day, indicating the distribution of poverty is not specific to a given country. In everywhere and specifically in developing countries people are suffering from food shortage, high infant mortality, lack of access to safe water, weak infrastructure, high unemployment, social deprivation such as empower less, despondency and others. The same report reveals that the expansion of poverty in terms of the number of poor and depth and severity of poverty is high in the sub-Saharan African countries.

Like poverty, Vulnerability is a multi-dimensional phenomenon, because it can be related to very different kinds of risks (Makoka & Kaplan, 2005). However, most studies deal with the vulnerability to natural disasters, climate change or poverty. Households in developing countries are frequently hit by severe idiosyncratic shocks (i.e. household-level shocks, such as death, injury or unemployment) and covariate shocks (i.e. community shocks, such as natural disasters or epidemics), resulting in high-income volatility (Günther and Harttgen, 2006). Some non-poor households are vulnerable to weather disturbances and economic shocks, bad harvest, a lost job or an illness by the major income earner in a household that easily push them in to poverty (Tabunda & Albert, 2002). 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.

In Ethiopia, Poverty and vulnerability to poverty is seen as a dynamic process which allows for putting in place proper proactive policy interventions to address poverty. Scholars have increasingly recognized that exploring vulnerability is very necessary for understanding ex-ante poverty dynamics and policy interventions. The dimension of poverty as low level of security is not appropriately measured in Ethiopia (Tassew, 2004). People everywhere face risks and vulnerabilities but poor people, especially those living in rural areas dependant on agriculture and in tropical ecologies face more than others. This is true of a large proportion of Sub-Saharan Africa's population. There are a number of risks and vulnerabilities that drive and maintain poverty in Ethiopia, including harvest failure, market failure and volatility, conflict, and health shocks.

The study area, Afar regional state, is the arid and semi-arid dominated by pastoralist and agro pastoralist households and it has been among economically and politically marginalized populations. Poverty remains particularly intense in the pastoral areas, in terms of low income and food consumption and high vulnerability for the risk of sudden drops in income. The coverage of social services and infrastructure are among the lowest in the country. Their traditional social, economic and political systems have been eroded. Above all, the lack of awareness and poor understanding of the pastoral way of life among the policy makers in the past has led to the exclusion of pastoralists' issues from policy development.

Thus, this study provides key fresh results of the extent and correlates of vulnerability to poverty by filling gaps and providing recommended solution for the existing problems in the study area.

The extents of vulnerability

Formulated poverty alleviation policy based on the extent of currently poor people may not consider the incidence of poverty in a period ahead (future poverty).

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, analysis of vulnerability complements poverty analysis through providing an ex-ante measure of welfare.

Applying the methods specified in the methodology part of this paper, an estimate of vulnerability for each household is generated. Considering the estimated vulnerability to poverty of the households, on average 50.14% households are vulnerable to poverty. It implies that there is a probability of around 0.50 of falling into poverty in a period ahead that is the head count poverty index in the next period.

Table 1. Extent of vulnerability

Vulnerability status	Percent (%)
vulnerable	50.14
Non vulnerable	49.86

Source: own computation

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), 49.86% of the households found vulnerable to poverty.

Table 2. Poverty and vulnerability (Percentage)

	Vulnerable	Non -Vulnerable	Total
Poor	95*	5.0*	100
Non-Poor	3.0**	97.0**	100
Total	50.14***	49.86***	100

Source: own calculation

*out of poor households

**out of non poor households

***out of total households

A result for the analysis of vulnerability to poverty is summarized in table 4.11. It shows that there is great association between poverty and vulnerability to poverty. The table above explicitly indicate the disproportion of the poor and the non-poor category of the sample size is decomposed into vulnerable and non-vulnerable depending on their *ex ante* consumption behaviour and variations in the future consumption. Accordingly 95 % of the poor are vulnerable while only 3% the non-poor are vulnerable to the future poverty.

Vulnerability by zone

Table 3. below summarizes average vulnerability to poverty in the study area estimated to be 50.14. The zone3 part of the study area were found to have the highest average vulnerability of approximately 52% while zone1 has about 48% average vulnerability to poverty. This could be linked with variation in the rainfall among various parts of the country. The respective vulnerability of the sample zones is proportional to the region vulnerability.

Table 3: Vulnerability to poverty profile

	vulnerable	Non vulnerable
Total	50.14***	49.86***
Zone1	48*	51**
Zone3	52*	49**

Source: own calculation

*** Out of total households

**out of non vulnerable households

*Out of the vulnerable households

Econometric Results

Determinants of vulnerability to poverty

The other objective of the study is to create household's current poverty profile and check out the extent of vulnerability to poverty and there by figuring out course of poverty in study area.

Formulated poverty alleviation policy based on the extent of currently poor people may not consider the incidence of poverty in a period ahead (future poverty). 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, analysis of vulnerability complements poverty analysis through providing an ex-ant measure of welfare.

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The Predicted value of the expected consumption and the variance of the expected consumption of households in the future bring sound indicator to what extent individual households subject to the vulnerability pipe line.

The GLS results indicates that expected log consumption per adult equivalent is negatively influenced by household size, dependency ratio, animal and crop disease, and positively affected by ownership of physical capital like farm size and livestock, irrigation, off farm income use of improved seeds Besides, the life cycle effects also exist, that is household's expected log consumption per adult equivalent increases with household head age but weakens afterwards.

The GLS result also indicates that expected log consumption per adult equivalent is positively influence by education status of head of household.

Table 4 GLS Regression: The expected value of log per adult equivalent Consumption expenditure

Expla.variables	Coef.	Std. Err.	P>z
Fmsize	-.0091534	.01231	0.057***
Age	.0111679	.01592	0.483
Sex	.0223645	.06091	0.713
Edustat	.0173931	.04529	0.061***
Assown	.348145	.12703	0.226
LndFer	.0561368	.04192	0.181
Dismark	.0238533	.08659	0.083***
Credit	-.1556761	.05574	0.005*
AgrExtpp	-.0553176	.07932	0.486
Fertilizer	.0407729	.07417	0.583
Impseed	-.1267379	.07036	0.042**
Irrig	-.2686792	.04924	0.000*
Offarmincom	-.2190615	.05060	0.000*
Animdises	-.0573585	.05312	0.280
cropdises	-.2361606	.05094	0.000*
Food aid	.1252703	.05112	0.014**
Tlndsize	.494848	.12896	0.000*
TLU	.0035595	.01675	0.082***
age2	-.0000836	.00016	0.618
Dipratio	.1013673	.04352	0.220
_cons	8.287329	.45197	0.000

Prob > chi2 = 0.0000

R-squared = 0.63

Adj R-squared = 0.61

*1% level of significance, **5% level of significance, ***10%level of significance

Following FGLS estimation of vulnerability, we find the factors which influence the vulnerability to poverty, via OLS method and logit model.

Determinants of vulnerability using OLS

Like the analysis of poverty, measuring the extent of vulnerability to poverty and its description are not an end in the works of vulnerability studies. Hence, finding the factors that contribute to the vulnerability to poverty requires the regression analysis. The study used OLS regression analysis to identify the factors, which affect household's vulnerability to poverty. The dependent variable here is household's vulnerability to poverty generated by using FGLS estimation of the household vulnerability to poverty explained by the independent variables such as household characteristics, human capital, household's asset holding, off-farm income participation, access to credit, irrigation, access to fertilizer and improved seeds and other variables as well. The estimated results of OLS regression presented in table 5.

Table 5 OLS Regression: Correlates of Vulnerability to Poverty

Explanatory variabl	Coef.	Std. Err.	T	P>t
Fmsize	.0091534	.0123146	0.74	0.458
Age	-.0111679	.0159267	-0.70	0.083***
Sex	-.0223645	.0609104	-0.37	0.714
Edustat	-.0173931	.0452947	-0.38	0.701
Assown	-.348145	.1270358	-2.74	0.066***
LndFer	-.0561368	.0419258	-1.34	0.041**
Dismark	-.0238533	.0865994	-0.28	0.285
Credit	.1556761	.0557415	2.79	0.005*
AgrExtpp	-.0553176	.0793218	-0.70	0.086***
Fertilizer	-.0407729	.0741718	-0.55	0.233
Impseed	-.1267379	.0703645	-1.80	0.072***
Irrig	-.2686792	.0492497	-5.46	0.000*
Offarmincom	-.2190615	.0506078	-4.33	0.000*
Animdise	.0573585	.0531264	1.08	0.281
cropdise	.2361606	.0509454	4.64	0.200
Food aid	-.1252703	.0511285	-2.45	0.415
Tlndsize	-.494848	.1289668	-3.84	0.000*
TLU	-.0035595	.0167554	-0.21	0.080***
age2	.0000836	.0001676	0.50	0.018**
Depratio	.1013673	.0435288	2.33	0.020**
_cons	8.287329	.4519733	18.34	0.000

Prob > F = 0.0000

R-squared = 0.3270

Adj R-squared = 0.3077

*1% level of significance ** 5% level of significance *** 10% level f significant

Household Characteristics

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 10% 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.

Age square of the household head is positively, and significantly correlated to the vulnerability to poverty and statistically significant at 5% 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 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).

As can be seen from table 5, the coefficients of asset holding that is number of livestock that the household have is negatively and significantly associated with the household's vulnerability to poverty status. The households with a large number of livestock for example oxen have a lower level of vulnerability to poverty as compared to the households with less number of oxen and less livestock holdings. The 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 off farm activities, access to improved seeds and irrigation are negative and statistically significant at 1%, 10%, and 1% significance levels respectively. 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 off farm income on own business or other off farm activities are more secure and less vulnerable to poverty than households without income from off farm activities.

Households with fertile land are less vulnerable to poverty than households with less fertility of land. This is largely due to the fact that fertile land enables households to produce more and more in a given plot of land. Household with fertile land produces more output than household with less fertile. Thus, the household with high fertile land is with low level of vulnerability to poverty and vice versa. This is statistically significant at 5% level of significance. Land fertility maximizes probability of getting more profit from limited land this enables a household to acquire more profit and revenue timely leading to diversification of income /output and hence lower level of vulnerability to poverty.

According to the OLS result access to agricultural extension services reduces households' vulnerability to poverty implying the fact that agricultural 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. It is statistically significant at less than 10% level of significance.

Though not statistically significant, households with crop and animal disease attack become more vulnerable as compared to those households who are free from such shocks. This might be due the reasons that, crop and animal diseases reduces production and productivity of agriculture both livestock and crop subsector leading households vulnerable to poverty

Correlates of vulnerability to poverty using logit model

The estimation of the vulnerability to poverty requires knowledge of the ex ante probability distribution of the household's future consumption. A threshold is required to classify a household as poor or non poor; one must also specify a probability threshold. In this study the ex ante probability distribution of each household's future food and non food consumption is obtained from the estimated results. Assuming log normality, a prediction of each household's ex ante mean and variances of logarithmic caloric consumption per adult equivalent are sufficient to characterize a household's ex ante probability distribution of future consumption. Having knowledge of each household's probability distribution, combined with a caloric threshold, allows us to calculate each household's probability of shortfall.

Vulnerability estimation made using the available data of the study area revealed that almost 51% out of the total sampled rural households of the study area are vulnerable to poverty. These huge numbers of people are at risk of failure to meet the minimum calorie requirement for healthy life. This is to mean that they could not produce enough or they don't have other way to stand with shortage in agricultural production to satisfy their daily minimum requirement of food consumption and other basic needs. So finding factors that contribute to vulnerability to poverty goes beyond the descriptive analysis and requires employing econometric analysis. For this end, multivariate econometric analysis enables us to identify influencing factors of vulnerability to poverty. As discussed in the methodology part of this study, a logit model is estimated to identify influencing factors of vulnerability to poverty. The advantage of using this model is ease of specification and estimation.

Using the vulnerability indicator, which takes 1 if the household is highly vulnerable and 0 if the household is low vulnerable, and the explanatory variables the model was estimated following maximum likelihood procedure. The measurement of goodness of fit of the model shows that the model fit the data well. Moreover, the model is significant at 1% level of significance and the pseudo R^2 indicates that the model predicts vulnerability to poverty well. Therefore, based on of the chosen threshold of vulnerability to poverty we look through factors that influence house hold to be highly vulnerable.

As discussed above scrutinize the determinants of vulnerability to poverty the measure of vulnerability is used to classify households as highly vulnerable and low vulnerable. When vulnerability estimate is greater than or equal to 0.5 the house hold is grouped as highly vulnerable which takes 1 and 0 otherwise (when the vulnerability estimate is less than 0.5) regressed on the set of house hold characteristics. Explanatory variables used in the logit model are as shown in table below. The following section presents evidence on the influencing factors of vulnerability to poverty.

Table:6 Logistic estimation result of influencing factors of vulnerability (robust standard errors in parenthesis).

The dependent variable is dummy vulnerable which takes 1 if highly vulnerable and 0, for low vulnerable.

Explanatory varia	Coef. Std.	Err.	P>z	Mfx
Fmsize	.0267009	.0728697	0.071***	.066601
Age	-.0349049	.0934408	0.009*	-.187064
Sex	-.6489271	.3529877	0.166	-.1618632
Edustat	-.1016016	.2560767	0.092***	-.0253427
Assown	-.8206237	.6874577	0.233	-.2046899
LndFer	-.1464973	.2436903	0.048**	-.0365411
Dismark	-.6152536	.5162114	0.033**	-.113464
Credit	1.066175	.3126175	0.351	.2659383
AgrExtpp	-.378503	.4863243	0.036**	-.0944108
Fertilizer	-.3068181	.4121703	0.057***	-.0765303
Impseed	-.5079637	.3904611	0.093***	-.1267025
Irrig	-2.151736	.2651122	0.020**	-.5367119
Offarmincom	-2.000401	.2570578	0.000*	-.4989641
Animdis	.4396464	.2851074	0.123	.1096619
cropdis	.5212048	.2712367	0.255	.1300052
Food aid	-1.727853	.2573468	0.302	-.430982
Tlndsize	-1.223635	.7554705	0.005*	-.3052137
TLU	-.2061335	.0948966	0.030**	-.0514163
age2	.0003695	.0009816	0.077***	.0100922
Dipratio	-.104821	.2503222	0.075***	-.0261457
_cons	-10.51146	2.667203	0.000	

*1% level of significance** 5% level of significance***10% level of significance

Prob > chi2 = 0.0000

Pseudo R2 = 0.5518 The coefficient of Age of the household head is negative and significant at 1% level of significance implying that on average as the household head gets older the probability of being vulnerable to poverty decreases. But this effect weakens with age as we see from positive and significant coefficient on age square. This shows that increment of age reduces the probability of being vulnerable to poverty but after some point the increment of age increases vulnerability to poverty. This result is consistent with OLS regression result above. This result is as expected since older households are the ones with better experience in agriculture and possibly with accumulated wealth that could be used as buffer stock whenever faced food shortage. Moreover it is argued that it is natural to expect diversified income portfolio for older households. Marginal effect of age of household head shows as the household gets older the probability of being vulnerable to poverty decrease by 18.7% up to some point.

As one expects family size has positive and significant effect at 10% significance level on the probability of being highly vulnerable to poverty. Since larger family size means many mouths to share the available food and other non food items. This shows that households with larger family size are more prone to be poor in future (vulnerable). This may be because food, a rival good, tends to represent a substantial share of the budget of the poor (Lanjouw & Ravallion, 1995). In addition, there are high risks of declining soil productivity

in a subsistence economy where large household size is likely to increase competition for land use between cash crops and food crops (Abuka et al., 2007). This decline in soil productivity may result in long run vulnerability, as it may lead to low output levels, and, consequently, high risks of being consumption poor.

Dependency ratio is to be highly significant in determining the probability of farm household's vulnerability to poverty status in the study area. This variable is positively associated with the vulnerability status and significant at probability level of 10%. The households with large dependency ratio, having children of non-productive age, could face the probability of high vulnerability. Therefore, this agrees with the hypothesis dependency ratio have role to play in affecting vulnerability to poverty positively and significantly.

Substantial evidence shows that households subject to income shocks and facing imperfect insurance markets use their assets to maintain smooth consumption (Deaton, 1992). Household assets include livestock and farmland, etc and can be used to smooth consumption either by borrowing against them or by liquidating them. A familiar asset used for consumption smoothing in developing countries particularly in SSA is livestock (Fafchamps et al., 1996). For example Rosenzweig and Wolpin (1993) present compelling evidence that sales and purchases of livestock are used as consumption smoothing strategies. Kinsey et al. (1998) found that during the four droughts occurred in rural Zimbabwe over the period 1983-96, the most common self insurance form used to smooth consumption is the sale of cattle.

In line with the above strand of literature, evidence is found that ownership of assets such as land and livestock has negative and significant effect on the probability of high vulnerability to poverty. The ownership of livestock is highly statistically significant though the impact seems to be quite marginal. The marginal effect shows that a one unit increase in livestock number in (TLU) decreases the probability of vulnerability to poverty in the future by 5.14 percent keeping all other things constant. This might not be surprising in the sense that additional ownership of livestock has to be complemented with other resource if aimed to reduce vulnerability to poverty.

Size of farm land per adult equivalent which is significant at 1% probability level has negative influence on vulnerability to poverty in the study area. It implies that the probability of being vulnerable decreases with increase in farm size. This agree with the hypothesis that farmers who have larger farm land holding would be less poor and vulnerable than those with smaller land size, due to the fact that, larger farmers are associated with higher possibility to produce more food. With greater wealth and income which increases availability of capital that could increase the probability of investment in purchase of farm inputs which increases food production and hence ensuring food security of farm households.

The coefficient on the dummy variable for education level of the household head is negative and statistically significant at 10% level. From this one can infer that literate head of household has low vulnerability to poverty as compared to illiterate household headed households. As results depict in table 4.19 household heads education reduces the probability of being highly vulnerable to poverty by 2.5 percent. This is basically linked to better awareness of educated households to improved farm technologies and other livelihood opportunities than the illiterate households. As one possibly expects the result shows human capital is a key factor to mitigating vulnerability to poverty. This is as expected because the more the household head is educated the more probable the household to use modern agricultural technologies and better cope with risk and uncertainty which reduces the probability to fall in to poverty in the future.

Market distance has been found to be positively related with vulnerability and significant at less than 5 percent significance level. It was expected that households nearer to market centers had better chances to be non vulnerable to poverty than those who are away from market centers. The result was in agreement with the hypothesis stated that is the probability of being vulnerable increases with one unit increase in market distance.

Other logistic regression results of statistically significant variables like access to off farm income, access to fertilizer, improved seeds, fertility of land owned by households and agriculture extension services negatively affects the vulnerability to poverty and are quite consistent with results in OLS regression as indicated in table 5 above.

Conclusion

In the study area about 50.14 percent of the sample households are vulnerable to poverty that is this paper have estimated the vulnerability to poverty of households using 2014 cross sectional data drawn from the panel and found that on average there is .50 probability of entering into poverty a period ahead. Households from zone three are more poor and vulnerable than households whose residence is zone one.

Using GLS, OLS and logit regressions factors affecting vulnerability to poverty was analyzed. There is a strong correlation between the factors influencing poverty and vulnerability to poverty. However, to some extent, there are a few factors significantly associated with vulnerability only but not poverty and vice versa suggesting that identifying such factors are highly essential to dipping vulnerability and poverty at the same time in the study area.

Regression result from both OLS logit models shows that the vulnerability to poverty of the households

is positively and significantly correlated to household characteristics such as dependency ratio, age square and family size. On the other hand, age of household head, human capital (proxied by head education), physical asset holding such as livestock and size of farm land, agricultural extension services and use of fertilizer and improved seeds, access to off farm income and irrigation, e.t.c are a key to reducing vulnerability to poverty.