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Assessing Households Vulnerability to Poverty in Rural Oromiya - Ethiopia

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Abstract
This study is based on secondary data from HICES and WMS 2004/5 collected by CSA. The study has tried to examine the extent of vulnerability to poverty of households in rural Oromiya. It further looks through the determinants of vulnerability to poverty. An estimate of vulnerability to poverty shows that 17.93 percent of the non poor are highly vulnerable. The mean vulnerability for highly vulnerable households is found to be 0.62. The Logit model is used to investigate the determinants of vulnerability to poverty. From the estimation result of the model larger household sizes and illiterate head of household significantly increase the probability of the household to be vulnerable. Therefore ex ante measures to prevent households from becoming poor as well as ex post measures to alleviate those already in poverty should be combined in designing poverty reduction strategies.
Keywords: Rural Households; Oromiya. Poverty Reduction; Vulnerability to poverty

1. Introduction

Ethiopia is a country of great diversity in terms of topography, agro-ecological zones, cropping patterns, ethnicity, natural resources, and consequently in the livelihood patterns of the population. The agricultural sector is dominated by smallholder households who produce and cultivate more than 94% of the agricultural output (Demeke et al, 2003). The majority of people in Ethiopia are living in rural areas (83%) where poverty is more widespread than in urban areas. In Ethiopia poverty is pervasive, deep-rooted, and multi-faceted. Large proportions of its population lives under abject poverty in both urban and rural areas. About 44% of the population is below the nationally defined poverty line in 1999/2000, while it is 45% for rural population and 37% for urban population. According to the 2004/05 HICES, the proportion of poor people (poverty head count index) in the country is estimated to be 38.7%. While the proportion of the population below the poverty line stood at 39.3% in rural areas, it is estimated to be 35.1% in urban areas. Both the statistical test and the stochastic dominance analysis confirmed that for all indices (head count, poverty gap and poverty severity indices) urban areas have lower poverty than that of rural areas indicating that poverty is still more of a rural phenomenon.

Conventional poverty profiles and poverty status regressions are often criticized by policy makers for telling them a lot about who the poor are, but very little about what to do to combat poverty. Essentially this is because the correlates of poverty status are distinct from the dynamic processes that lead households to fall into or escape from poverty. An effective anti-poverty strategy should be based on intensity of vulnerability to poverty. To reduce poverty more effectively, anti poverty interventions should carry out from two essential aspects. One is ex-post poverty alleviation intervention such as providing subsidies, relief, and reducing taxes. The other is ex-ante poverty preventing interventions such as capacity building, education, offering opportunities of work to the poor, so as to reduce vulnerability to poverty. This research aims to provide evidence for setting different policy targets, and to suggest alternative policy interventions

The Ethiopian government has been constantly pursuing development efforts addressing mainly rural poverty. In Ethiopia although the poverty alleviation funds have risen year after year there are evidences that poverty has not been reduced as targeted, like 20 years ago the country is in need of food aid; still a majority of the population hover around the poverty line; there are large entries into poverty compared to those who exit. This requires not only a deep look at the factors responsible for poverty but also the defencelessness of the poor and vulnerability to poverty. Many rural Ethiopians cycle around the poverty line, moving in and out of poverty and food insecurity during the course of a year. With so many households cycling around the cusp of severe poverty, a shock is often all it takes to push them into poverty.

Poverty as a vulnerability concept is now 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. Carlo et al. (2006) announced that risk and vulnerability considerations in poverty analysis will be future directions. The

dimension of poverty as low level of security is not appropriately measured in Ethiopia (Woldehanna, 2005). 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 (Diamond, 1999). This is true of a large proportion of Sub-Saharan Africa's (SSA's) population in general and for Ethiopia in particular.

Identifying who is poor, who is not, and the characteristics of those who are, is not enough for structuring poverty alleviation policies. "Poverty is a stochastic phenomenon." (Chaudhuri et al: 2001). Policy analysts focusing attention on the current poor may overlook important segments of the population who, while not currently impoverished, are however susceptible to poverty. Those people who are currently not poor may fall below the poverty line, and it is also possible for people who are currently poor to escape from poverty. Therefore, appropriate anti-poverty policy interventions need to look at not just who is poor today, but also who is likely to be poor in the future. This leads us to the concept of 'vulnerability to poverty', which is the risk that a household would become poor in the near future (Suryahadi and Sumarto, 2001). In this regard, the study would look into the vulnerability of households to poverty and try to examine the household's characteristics, which are likely to be associated with vulnerability.

Through identifying some of the key micro level binding constraints to poverty and vulnerability reduction, the study will also provide a critical insights for policy makers to trace out the relative contribution of different influences on poverty and to trace out major causes of poverty and vulnerability among the referred populations and their inter-linkages. The study also forwards the probable solution to overcome these problems in designing effective poverty reduction strategies. So this study is initiated to fill this gap.

2. Data

This study is based on the 2004/05 Household Income, Consumption and expenditure Survey (HICES) and Welfare Monitoring Survey (WMS) that were conducted by Central Statistical Authority (CSA). These surveys covered the population in sedentary areas of the country (the nine Regional States and two administrative regions) on a sample basis, each of which is composed of rural and urban parts excluding the non-sedentary population in Afar and Somalia Regional States and residents of collective quarter, homeless persons and foreigners (CSA: 2005). A stratified two-stage sample designing was used to select the sample. The primary sampling units were enumeration areas (EAs). Sample EAs from each domain were selected using systematic sampling that is probability proportional to size; size being number of households obtained from the 1994 population and housing census. In doing this, a total of 1264 EAs (722 in rural and 542 in urban areas) were selected to be covered in each round of the survey in all regions. Then, in each round the survey was conducted on the basis of 12 rural and 16 urban households systematically selected form each EA. And ultimately, a total of 8672 households have been covered in urban areas all over the country (CSA, 2005).

The household based questionnaires in both surveys provide information regarding the basic population characteristics such as sex, age, household size, marital status, education and employment. And in particular, the HICES include information regarding the household consumption ; food and non-food consumption; as well as quantities consumed; payments; receipts; and income. The food consumption is calculated by adding up the value of subsistence food consumption to cash consumption on food. The non-food consumption are cigarettes, alcohol, clothes, household goods, transports, ceremonial expenditures, health, education, value of water, firewood and other fuel, and imputed value is used for those not pausing for these commodities. The WMS also provides detailed information on the different dimensions of poverty and welfare particularly non-income dimensions of poverty such as the status of education, health and vulnerability i.e., access to education and health facilities, achievements in education, anthropometrics measures, and underlying bases of the poor and on the opportunities available to households. For measuring poverty and vulnerability and investigating the relationship between the two, detailed information is required on characteristics of households such as household size, demographics and resource endowments, and their income and consumption. Net income refers to the household's income in cash and in kind after deducting all costs and taxes. Consumption is the expenditure on food and non-food items such as clothing, housing, health, education, transport and communication, recreation and entertainment.

The main data sources used for measuring poverty in Ethiopia are Household Income and Consumption Survey (HICES) and Welfare Monitoring Survey (WMS) conducted by Central Statistical Authority (CSA) of Ethiopia. The HICES is conducted mainly to provide data on the levels, distribution and pattern of household income, consumption, and consumption can be used for the analysis of changes in the living standard (poverty) of household over time for various socio-economic groups and geographical areas. It provides information on the consumption of food and non-food item, household consumption , payments, receipts and income, and household characteristics such as family composition, education and occupation. This survey is used to measure the income dimension of poverty. The WMS is conducted mainly for the purpose of assessing

non-income dimensions of poverty such as education, health and vulnerability. HICES is a sub-sample of WMS and it enumerated the same households.

3. Analysis of Household Vulnerability to Poverty

In this study, the vulnerability to poverty measure proposed by Chaudhuri (2003), Chaudhuri et al. (2002), Suryahadi and Sumarto (2003) and Azam and Imai (2009) developed particularly for cross-section data is used. Hence, there is a need to develop a method for estimating household consumption variance from cross-section data. This, however, obviously requires relatively strong assumptions about the stochastic process generating consumption. Vulnerability in this context is defined as expected poverty, or in other words as the probability that a household's consumption will lie below the predetermined poverty line in the near future.

Following Chaudhuri (2003) and Azam (2009), for a given household , the vulnerability is defined as the probability of its consumption being below the poverty line in the future

$$V_h = pr(\ln c_h < \ln z) \quad \text{---------- (1)}$$

Where V_h vulnerability of household h, c denotes the per capita consumption of household h and z stands for the poverty line (national poverty line or food poverty line) of household consumption. The probability that a household will find itself poor depends not only on its expected (mean) consumption but also on the volatility (i.e., variance, from an inter-temporal perspective) of its consumption stream. Therefore, both estimates (household expected consumption and the variance of its consumption) are required to quantify the level of household's vulnerability to poverty. Assuming that for household h the data generation process for consumption is captured by the following equation:

$$\ln c_h = X_h\beta + \varepsilon_h \quad \text{---------- (2)}$$

Where c_h stands for per capita consumption for household h, X_h represents a vector of observable household characteristics (containing both household and community elements) such as such as household size, gender of household head, educational attainment of the head of household etc , β is a vector of parameters, and ε_h is mean-zero disturbance term that captures household's idiosyncratic factors (shocks) contributing to differential level of per capita consumption for households that share the same characteristics. The vulnerability to poverty of household h with characteristics X_h can now be calculated by:

$$\hat{V}_h = \hat{pr}(\ln c_h < \ln z \mid X_h) = \phi\left[\frac{\ln c - X_h\hat{\beta}}{\hat{\sigma}}\right] \quad \text{---------- (3)}$$

Where $\hat{V}_h$ denotes predicted vulnerability to poverty, that is the probability that the per capita consumption level (c_h) will be lower than the poverty line (z) conditional on household characteristics X_h .X_hB, household's expected log consumption calculated from equation (2) Meanwhile, $\phi(.)$ denotes the cumulative density of the standard normal distribution and $\hat{\sigma}$ is the standard error of the error term in (2).

Two assumptions are necessary to make when vulnerability is estimated from a single cross-section. First, it is assumed that the idiosyncratic shocks to consumption are identically and independently distributed over time for each household. This implies that unobservable sources of persistence (arising for example, from serially correlated shocks or unobserved household-specific effects) over time in the consumption level of an individual household are ruled out. Second, it is also necessary to assume that the structure of the economy (captured by the vector β) is relatively stable over time, ruling out the possibility of aggregate shocks (i.e., unanticipated structural changes in the economy). By assuming a fixed β over time, it implies that the uncertainty about future consumption stems solely from the uncertainty about the idiosyncratic shock, *Eh*, that the household will experience in the future. The variance *Eh* however is not identically distributed across households and depends upon observable household characteristics.

To have a consistent estimate of the parameters, it is necessary to allow heteroskedasticity, that is, variances of the disturbance term to vary between households. This is appealing since the economic interpretation of the

variance of the disturbance term is as intertemporal variance of log consumption in this setting. Assuming constant variance of the disturbance term means that the households have constant variance in log consumption. This is contrary to empirical evidence since poor households have more variance in consumption than their counterpart non-poor (Chaudhuari,2003). This can take the following functional form:

$$\sigma^2{}_{e,h} = Z_h\theta = X_h\theta_{ij} + \eta_h \quad \text{---------- (4)}$$

A three-step Feasible Generalized Least Squares (FGLS) procedure can be used to estimate the parameter θ. Equation (2) is first estimated using an ordinary least squares (OLS) procedure. Then, the estimated residuals from the equation (2) are used to estimate the following equation, again by OLS:

$$\hat{e}^2{}_{ols} = Z_h\theta + \eta_h = X_h\theta_{ij} + \eta_h \text{----------} (5)$$

The estimate from above is then used to transform the equation (5) into the following:

$$\frac{\hat{e}^2{}_{OLS,h}}{Z_h\hat{\theta}OLS} = \left[\frac{Z_h}{Z_h\hat{\theta}_{OLS}}\right]\theta + \frac{\eta_h}{Z_h\hat{\theta}_{OLS}} \quad \text{---------- (6)}$$

This transformed equation is estimated using OLS to obtain an asymptotically efficient FGLS estimate, $\hat{\theta}_{FGLS}$. $Z_h\hat{\theta}_{FGLS}$ is a consistent estimate of $\sigma^2{}_{e,h}$, which is the variance of the idiosyncratic component of household consumption.

This is then used to transform equation (2) into:

$$\frac{\ln c_h}{\sqrt{Z_h\hat{\theta}_{FGLS}}} = \left[\frac{X_h}{\sqrt{Z_h\hat{\theta}_{FGLS}}}\right]\beta + \frac{e_h}{\sqrt{Z_h\hat{\theta}_{FGLS}}} \quad \text{---------- (7)}$$

OLS estimation of equation (7) yields a consistent and asymptotically efficient estimate of β . Finally, the estimates of β and θ obtained through this FGLS method can be used to estimate the vulnerability to poverty of household h through the following generalization of the equation (3):

$$\hat{V}_h = \phi\left[\frac{\ln c - Xh\hat{\beta}}{\sqrt{Xh\hat{\theta}_{ij}}}\right] \text{----------} (8)$$

This is an ex ante vulnerability measure that can be estimated by cross-sectional data. Equation (8) will provide the probability of a household a becoming poor given the present distribution of consumption . A merit of this vulnerability measure is that it can be estimated by cross-sectional data. However, the measure correctly reflects a household's vulnerability only if the distribution of consumption across households, given the household characteristics at one time, represents the time-series variation of consumption of the household. Hence this measure requires a large sample in which some households experience a good period and others suffer from negative shocks.

4. Extent of Vulnerability to Poverty

Vulnerability to poverty computed as a probability that the household's welfare will be less than a given threshold (poverty line) next period. Using the method specified in the methodology part of this paper, we

generate an estimate of vulnerability for each household. As discussed in the methodology section of this thesis we estimate a regression model of the relationship between a household's consumption level and its characteristics. However, as some types of households may experience bigger fluctuations in their consumption levels than others, we allow the residual error term of the regression (which considers transitory fluctuations among other things) also to vary with (a potentially different set of) household characteristics. This model is used as the basis for assessing vulnerability of households to consumption poverty. The poverty line used in the estimation is the already described absolute total poverty line. The results summarize vulnerability to poverty (i.e., the probability that a household will be vulnerable), and amongst the vulnerable we distinguish those whom we term the relatively low vulnerable (i.e., those who have an estimated vulnerability level less than 0.5); and those whom we term the highly vulnerable because we estimate that they are more likely to experience poverty (i.e., those who have an estimated vulnerability level greater than 0.5).

5. Category of Households in to Different Vulnerability Group

Table 1 provides an estimate of vulnerability to poverty. Households with vulnerability index greater or equal to 0.5 are grouped as high vulnerable group (HVG) and households with vulnerability index less than 0.5 are grouped as low vulnerable group (LVG). Non poor households with vulnerability index greater or equal to 0.5 are grouped as high vulnerable non poor (HVNP). 47.66 percent (1108) of households out of the total sampled households are highly vulnerable to poverty (has a vulnerability index greater or equal to 0.5 or has a probability of 50 percent and above to fall in to poverty in the near future) and 17.93 percent of the non poor are highly vulnerable to poverty. But based on the data used for this study only 37% of households in rural Oromiya are poor in the year 2004/5. This shows that expected poverty is much higher than the point-in-time estimates of poverty, which connote the importance of forward looking poverty analysis. Arguably, this indicates that point-in-time estimate poverty might be underestimated.

Table 1 Category of households in to relative vulnerability group

Vulnerability category	Households	Percent
LVNP	1167	95.89***
LVP	50	4.11***
TOTAL LVG	1217	52.34*
HVNP	255	17.93****
HVP	853	94.46**
TOTAL HVG	11O8	47.66*

*out of the total households, **out of poor households, ***out of low vulnerable group **** out of non poor households.

Moreover table 2 summarizes the mean vulnerability for different group of households. The mean vulnerability of households with vulnerability index greater or equal to 0.5(HVG) is found to be 0.62 for rural Oromiya. This means highly vulnerable households who are not currently poor have on average a probability of 0.62 to fall in to poverty and highly vulnerable poor households have a probability of 0.62 to remain poor. The mean vulnerability for all households is also high (0.46). This means the households have a probability of 0.46 to be poor or remain poor.

Table 2 mean vulnerability index

Vulnerability index	Frequency	Mean	Standard deviation
Vh<0.5	1217	0.35	0.104
Vh>=0.5	884	0.62	0.082
Total vh	2101	0.46	0.161

Vh<0.5 relatively low vulnerable group
Vh>=0.5 relatively high vulnerable group
Vh = total vulnerability

6. The Empirical Model

In exploring the correlates of vulnerability to poverty by using per adult equivalent consumption expenditure as the endogenous variable is to perform categorical data analysis such as Probit, Logit or Tobit. These models estimate the probabilities of being poor using maximum likelihood estimation (MLE) while accounting for the discrete nature of the dependent variable
(Greene, 2002). Binary response models (e.g. probit, logit) are used where vulnerability to poverty is considered as a "yes" or "no" decision (Bogale, 2011)

To investigate the determinants of vulnerability to poverty, the measure of y and vulnerability to poverty is, regressed on the set of household characteristics. The model of vulnerability to poverty is:

$V_h = X_h\gamma + \varepsilon_h$ ---------- (10)

=0 otherwise Where v_h is vulnerability to poverty , γ is a Kx1 vector of unknown parameters, X_h is 1xK vector of explanatory variables, and ε_h are models residuals.

7. Empirical Results and Discussion

To identify the possible determinants of the vulnerability to poverty the vulnerability index is used in classify households as highly vulnerable and low vulnerable. When the vulnerability to poverty is greater or equal to 0.5 the household is grouped as high vulnerable group which takes the value of 1 and 0 otherwise (when the vulnerability index is less than 0.5 for the group) as dependent variable is estimated using the same explanatory variables used to identify the determinants of poverty by the logistic estimation. The result of the logit estimation is given in table 3

Age of Head of household has a positive sign and significant at 1%. This showing that on average as the age of the household increases vulnerability to poverty increases. This is as expected because as age the head increase the household acquires more skill, experience and accumulated asset that tends to decrease vulnerability to poverty. Household header ship does not affect vulnerable to poverty.

The coefficient for household size has positive sign and significant at one percent which confirm that household size exerts more pressure on consumption than it contributes to production. This show as household size increases the vulnerability to poverty increase. But the square of household size has negative sign and significant at one percent this shows increment of household size after a certain level negatively affects the household probability to be poor. This means current large family size can be a good labor force for the household in the future that reduces the vulnerability to poverty. Except for household head with some primary education the other education dummies are insignificant. From this one can infer that compared to the base category illiterate head of household with some secondary and tertiary education has low 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. As to the location dummy households living Borena zones have high vulnerability to poverty

Table 3 logistic estimation of determinants of vulnerability

Vulnerability to poverty	Coefficients	Dy/dx	Robust std.err	Z	P>|z|
Household's demographic characteristics					
HAGE	-.0403078	-.0220394	. 022393	-1.80	0.072***
HAGE2	.0001794	.0002794	. 0002404	.75	0.455
HSEXD1+	-.0055816	-.1174178	.1416913	-0.04	0.969
HHSIZE	.437813	-.016177	. 1129058	12.73	0.000*
HHSIZE2	-.0772116	-.0074274	0077638	-9.95	0.000*
ELDER	.1707976	-.0741859	1562875	1.09	0.274
JUNIOR	-. 0436149	-.0530255	. 0360271	-1.21	0.226
Household head education					
HEDUCD2+	-.135929	-.0192922	.1202634	-1.13	0.258
HEDUCD3+	-1.495144	-.2180191	.7780524	-1.92	0.055***
HEDUCD4+	-1.347011	-.0729334	.6671602	-2.02	0.043**
Dummies of locations					
East Wellega+	-.1562625	-.0108137	2415746	-0.65	0.518
Jima+	.2811382	.1130566	. 2365631	1.19	0.235
Illubabor+	-.6619036	-.0405712	. 2348087	-2.82	0.005*
West Shoa+	-.0149692	-.0257354	. 2471482	-0.06	0.952
North Shewa+	-.8712317	-.0764731	. 2657902	-3.28	0.001*
East Shewa+	-.259825	-.0447143	. 2361952	-1.10	0.271
Arsai+	-.1926477	-.0114482	. 2276561	-0.85	0.397
WestHararghe+	-1.392302	-.2047533	2566487	-5.42	0.000*
East Hararghe+	-.4314064	-.2047533	. 2378886	-1.81	0.070***
Bale+	-.108141	-.0128491	. 2557969	-0.42	0.672
Borena+	.770007	.1753621	. 2465604	3.12	0.002*
SouthWestShewa+	-.5019594	-.039276	. 2759236	-1.82	0.069***
Guji+	-.9486032	-.0730951	. 2613227	-3.63	0.000 *
Constant	-3.804202		. 5211163	-7.30	0.000

(+) dy/dx is for discrete change of dummy variable from 0 to 1

* Significant at the 1% level; **Significant at the 5% level; ***Significant at the 10% level

Log pseudolikelihood = -1246.2108

Number of obs	=	2322
Wald chi2(23)	=	412.59
Prob > chi2	=	0.0000
Pseudo R2	=	0.2013

8. Conclusions

An estimate of vulnerability shows that 47.66 percent (1108) of households out of the total sampled households are highly vulnerable to poverty and 17.93 percent of the non poor are highly vulnerable to poverty. The mean vulnerability for highly vulnerable households is found to be 0.62 for rural Oromiya. The mean vulnerability for all households is also high (0.46).

Most of the findings in the descriptive analysis are consistence with the result obtained from multivariate model. The estimation of the model for determinants of poverty shows that larger household sizes significantly increase the probability of the household to be poor. Similarly the probability of being poor is on average higher for male headed households relative to the male headed households. On the other hand literate household head has negative effect on poverty. In general, households with large family size, illiterate are more likely to be poor than those with smaller family size and educated and household heads. And finally, residents Borena zone are found to be worse than those living in other zones in terms of poverty and vulnerability.

Similarly the estimation of the model for determinants of vulnerability shows that larger household sizes and illiterate head of household significantly increase the probability of the household to be poor. And finally,

residents Borena zone are found to be worse than those living in other zones in terms of vulnerability. It seems that the determinants of poverty and vulnerability are similar since those variables that have significant effect on poverty also have significant effect on vulnerability.

A sizeable portion of households that are now non-poor are certainly vulnerable to falling into poverty in future. This has policy implications that ex ante measures should be enhanced to prevent as many households as possible from becoming poor and therefore such results should be taken into account, particularly when policy makers design social policy in addition to ex post measures to alleviate those already in poverty.

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