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Quantifying Vulnerability to Poverty in the Drought-Prone Lowlands of Ethiopia

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Abstract

A forward-looking measure of "vulnerability to poverty" is estimated and a concerted effort is made to understand the sources of vulnerability in the drought-prone lowlands of Ethiopia. Using the Household Consumption Expenditure Survey and the Welfare Monitoring Survey of 2016, the analysis reveals that vulnerability is remarkably higher in the drought-prone lowlands than in the other ecological zones, although differences in poverty rates are modest; the vulnerability rate is more than two times larger than the poverty rate in the lowlands, while the ratio is only 1.6 for the whole country. The analysis also reveals important distinctions in the sources of vulnerability. In the drought-prone lowlands: (i) vulnerability due to aggregate shocks such as droughts is lower than vulnerability due to idiosyncratic shocks in absolute terms, but its relative importance is higher compared with other ecological zones; and (ii) poverty-induced vulnerability is relatively more important than risk-induced vulnerability in contrast to other regions where risk-induced vulnerability is higher than poverty-induced vulnerability. These findings attest to the unique nature of the drought-prone lowlands compared with the other agroecological zones and points in favor of policies and programs tailored specifically to the areas.

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1. Introduction

Ethiopia's economy has been growing fast in the last two decades leading to a significant poverty reduction. Poverty, based on the national poverty line, decreased from 46 percent in 1996 to 24 percent in 2016.[1] Despite the important progress made in poverty reduction, the incidence of shocks, such as drought, and other crises can push many households below the poverty line, resulting in poverty increasing significantly during some periods.[2] The distinction between the poverty status of a household at a given point in time and the vulnerability of a household to poverty, which is about the likelihood of a household being poor in the future, is particularly useful for the development of a safety net system that reduces the need for recurrent humanitarian appeals by supporting not only the chronically poor but also being able to expand coverage to new beneficiaries during droughts and contributes to increased household resilience to shocks.

According to EDRI (2009), Ethiopia can be grouped into four major ecological zones, namely, the moisture-reliable highlands, the drought-prone highlands, the moisture-reliable lowlands and the drought-prone lowlands and pastoral areas (see map in the annex). Households in the drought-prone and pastoral-lowlands (hereafter referred simply as drought-prone lowlands) depend on extensive livestock herding and/or farming in a highly variable and marginal environment. These areas are also characterized by low human capital accumulation and weak governance. However, the average consumption level is not noticeably different from that of the other three ecological zones.[3] While the drought-prone lowlands hold about 12 percent of the population, they encompass more than 50% of the country's area. Administratively the drought-prone lowlands cover the Afar and Somali regions in the East and parts of the Oromia and SNNP regions in the South.

Although households in the drought-prone lowlands have fairly diverse livelihoods, they all have to simultaneously manage risks to financial assets (livestock) and food security in the context of shocks. Major shocks consist of weather events such as recurrent droughts and floods, decreasing land for farming and grazing because of *prosopis juliflora* invasion, increased population, agricultural

[1] FDRE (2017); World Bank (2020).

[2] For a detailed discussion on the risk and frequency of drought in Ethiopia, see Robinson et al. (2013) and Zeleke et al. (2017).

[3] In 2011, the poverty rate in the drought-prone lowlands was 27 percent as opposed to the national poverty rate of 24 percent.

concessions, and conflicts.[4] Potential vulnerability is compounded by low levels of human capital accumulation and weak governance. In such a context, characterized by repeated droughts and a high volatility in consumption, standard poverty measures such as the poverty headcount rate only assess the current poverty status of a household but are not necessarily an indicator of future poverty status. For example, the current consumption of a household may be above the poverty line and thus they are classified as non-poor, but due to the high likelihood of shocks between the current and next period, the same household may fall below the poverty line in the next period. Such a household is "vulnerable to poverty" even though their current consumption is above the poverty line. In general, the extent of vulnerability to poverty depends on the risk management strategies of households and communities, the abilities of households to cope after the incidence of the shock (e.g., assets owned, herd size, social capital), and access to safety nets.[5] Understanding the extent and the sources of vulnerability in the drought-prone lowlands has important policy implications.

While the profile of poverty and its evolution over time are relatively well documented in Ethiopia, there is very limited evidence on the extent and nature of vulnerability to poverty. The available studies either focus on a specific shock (such as drought or price rise) and/or do not provide any estimates for the drought-prone lowlands. Hill and Porter (2017), for example, study vulnerability to drought and food price shocks and its determinants using historical climatic and price data along a nationally representative household survey from 2005 and 2011. They find that drought and price increases lead to significant reduction in consumption and hence vulnerability to poverty. Demissie and Kassie (2017) study vulnerability in rural areas by cross-sectionally estimating the probability of households' consumption falling below the poverty line in the future and defining a household as vulnerable if the probability is higher than a certain threshold. Using the 2011 Household Consumption Expenditure Survey (HCES) and Welfare Monitoring Survey (WMS), they find that vulnerability to poverty in 2011 was 54 percent in rural Ethiopia as opposed to a poverty rate of 31 percent.

[4] For a detailed discussion on the shocks in the drought-prone lowlands, refer to World Bank and DFID (2019).

[5] Vulnerability to poverty is related to the concept of "resilience" which concerns the longer time-path of well-being in the face of shocks, and especially the likelihood that any adverse outcomes of either risk avoidance or a realized shock do not persist for an extended period. For example, a nonpoor household may be vulnerable to becoming poor due to job loss yet be quite resilient if the prospects for finding follow-on employment offering similar compensation are high and/or formal or informal safety-net programs reliably provide adequate support reasonably promptly. In statistical terms, a nonpoor household with high conditional variance of income might be both vulnerable (to becoming poor) and resilient (because the poverty is sufficiently low in duration, intensity, and/or likelihood) (Barrett and Constas, 2014).

In this paper we take advantage of the 2016 HCES/WMS data which is representative for the drought-prone lowlands unlike earlier rounds, and provide estimates of the vulnerability to poverty for the drought-prone lowlands relative to the other ecological zones of Ethiopia using a two-level hierarchical regression model first proposed by Guenther and Harttgen (2009). As in Demissie and Kassie (2017), the Gunther and Harttgen model uses cross sectional data to get *ex ante* estimates of the mean and variance of consumption, but it also allows the distinction between idiosyncratic (household level) and covariate (community level) shocks. In addition, the model also allows the decomposition of vulnerability into poverty-induced and risk-induced vulnerability.

To the best of our knowledge, this constitutes the first study on vulnerability focusing on the drought-prone lowlands. We find that the incidence of vulnerably in the drought-prone lowlands is two times the incidence of poverty– 56 percent versus 27 percent. Although the poverty rate is relatively higher in the drought-prone lowlands than any of the other ecological zones, the prevalence of vulnerability is remarkably higher. The incidence of poverty and vulnerability for the nation as a whole is 23 percent and 38 percent, respectively. While both poverty induced (vulnerability due to low average consumption) and risk induced (vulnerability due to high consumption variability) vulnerabilities are higher in the drought-prone lowlands, the relative importance of poverty induced vulnerability is higher in the drought-prone lowlands than in other ecological zones – the ratio of poverty induced vulnerability to risk induced vulnerability is 1.5 in the drought prone low lands as opposed to 0.9 for the whole country. Similarly, although vulnerability rates due to both covariate and idiosyncratic shocks are higher in the drought-prone lowlands, the relative importance of vulnerability associated with covariate shocks is higher in the drought-prone lowlands than in the rest of the country.

The remainder of the paper is organized as follows. In section 2, we present an intuitive explanation of the distinction between poverty and vulnerability and in section 3, we discuss the estimation technique applied. Section 4 describes the data, and section 5 presents the estimation results and discussion. Section 6 concludes.

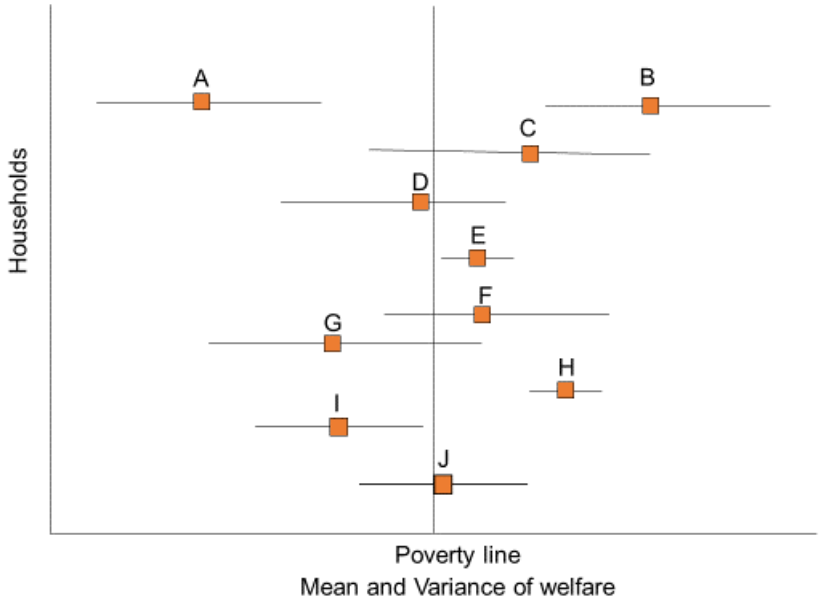
2. Distinction between poverty and vulnerability to poverty

The "vulnerability to poverty" measure employed in this paper rests on the characterization of welfare (measured by income or consumption) by its mean and variance. Figure 1 summarizes these

two dimensions of welfare for 10 hypothetical households (households A, B,… ,J). The mean consumption of a household (or the average value of consumption, for example, associated with many different shocks or states of the world over time) is depicted by the orange square. Different shocks at different points in time lead to variation around the mean value of consumption, and the variance of consumption is depicted by the width of the horizontal lines to the left and right of the mean value. Thus, households differ with respect to the mean and the variance of their expenditure, with some households having a low (or high) mean level of consumption and a low (or high) variance of consumption. Household A, for example, is on average a poor household with a low mean consumption placing it below the poverty line, depicted by the vertical line in Figure 1, whereas household B is on average a non-poor household with a higher level of mean consumption located above the poverty line. Households A, D, G and I are on average poor households and their vulnerability is "poverty induced", meaning that vulnerability is primarily determined by low endowments of livestock assets and human capital. Households B, C, E, F, H and J are on average non-poor households as their mean welfare is above the poverty line. However, some of these households are vulnerable to poverty while others are not. Households B, E and H, for example, have variability in their consumption but the variance never crosses the poverty line. In contrast, households C, F, and J may end up below the poverty line under some circumstances, as depicted by the fact that the variance of their consumption around the mean crosses the poverty line. For households C, F, and J, vulnerability to poverty is "risk induced".[6]

[6] Figure 1 is also useful for highlighting the difference between poverty and vulnerability headcount measures. The poverty headcount is based on the fraction of households whose consumption happens to be below the poverty line at a particular point in time. Depending on the timing of measurement and the type of shocks experienced (as well as the capacity of households to mitigate the impacts of such shocks ex ante or cope with these shocks ex post), the poverty headcount may range anywhere between 20% (only households A and I) and 70% (households A, C, D, F, G, I, and J). In contrast, the vulnerability headcount rate (assuming a very low probability threshold) is simply 70%.

Figure 1: Vulnerability to Poverty Characterized by the Mean and Variance of Welfare



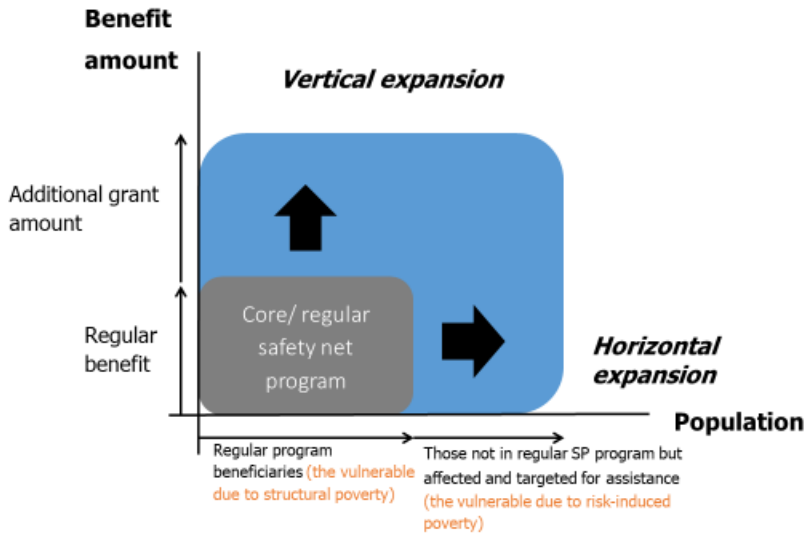
An understanding of the sources of vulnerability to poverty is necessary for the design of policies that increase the overall resilience of household welfare to shocks.[7] To the extent vulnerability to poverty is "poverty induced" (i.e., low assets and human capital endowments) then cash transfer programs or programs enhancing the delivery of basic services facilitating investments in physical and human capital are likely to be the most appropriate. In contrast, if vulnerability is primarily "risk induced" (i.e., high uninsured income fluctuations) then an insurance type of program may be needed to increase resilience.

Figure 2 demonstrates how an existing social assistance program covering primarily the chronic poor (the gray square in Figure 2 represents core/regular safety net program) can be adapted to provide insurance and become more of an adaptive social protection or safety net program. In order to

[7] Vulnerability to poverty is related to the concept of "resilience", which tells that the time-path of the well-being in the face of shocks, especially the likelihood of any adverse outcome of either a risk avoidance or a realized shock, does not persist for an extended period. For example, a nonpoor household may be vulnerable due to job loss yet be quite resilient if the prospects for finding follow-on employment with similar compensation are high or if formal or informal safety-net programs can provide adequate support promptly. In statistical terms, a nonpoor household with high conditional variance of income might be both vulnerable (to becoming poor) and resilient, because vulnerability to poverty can be either poverty-induced (structural) which is driven by low average consumption of households or risk-induced (transitory) which is due to high consumption variability/volatility sufficiently low in duration, intensity, and/or likelihood (Barrett and Constas, 2014).

ensure that the welfare of the chronic poor remains unaffected by the shock, the size of the benefits provided could be increased – vertical expansion. The safety-net program could also provide insurance by expanding coverage to those who fall into poverty due to the shock – horizontal expansion.

Figure 2: An Adaptive Social Safety Net Targeting the Vulnerable to Poverty



3. Empirical strategy

Estimating the vulnerability of a household to poverty requires the mean and variance of the household welfare, and ideally, the household specific mean and variance of welfare should be derived from many repeated observations of household welfare in different states of the world. Unfortunately, this is not feasible since most panel data sets of household welfare only contain 3 or 4 rounds of repeated observations on the same households over time, which are not sufficient for the construction of a reliable estimate of the mean and variance of welfare for the purpose of estimating vulnerability to poverty. Moreover, many countries do not have any panel surveys of households. Given the above, the most practical approach is to construct a measure of vulnerability taking advantage of cross-sectional variability based on some rather strong assumptions.

In this paper, the method used to estimate vulnerability to poverty is based on Gunther and Hartgen (2009) who integrated a two-level hierarchical model (e.g. Hox, 2010) into Chaudhuri's (2002, 2003)

method to estimate vulnerability from cross-sectional or short panel data, thus resolving the problem of missing lengthy panel data (see, e.g., Chaudhuri, Jalan, and Suryahadi, 2002; for applications). The two key features of the model are (i) the error term in the consumption regression or the unexplained variance in the consumption of otherwise identical households, is decomposed into household-specific and community (woreda)-specific shocks to household consumption; and (ii) the variance of these two types of shocks is then modeled as a function of observable household and community (woreda) characteristics.[8]

Specifically, let $i = 1, \ldots, N$ denote households at level one and $j = 1, \ldots, J$ denote communities (woredas) at level two, with households being nested within communities (woredas). Consumption, c, of household *i* in community *j* is specified as

$$lnc_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + e_{ij} \qquad (1)$$

The coefficients (both constant term and slopes) of each community are assumed to be affected by community observed characteristics (Z) and community unobserved factors denoted by u_{0j} and u_{1j}.

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Z_j + u_{0j} \qquad (2)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11} Z_j + u_{1j} \qquad (3)$$

Substituting (2) & (3) into (1) yields the regression equation

$$lnc_{ij} = \gamma_{00} + \gamma_{01} Z_j + (\gamma_{10} + \gamma_{11} Z_j) X_{ij} + u_{0j} + u_{1j} X_{ij} + e_{ij} \qquad (4a)$$

Thus, there are 3 error terms to be estimated u_{0j}, u_{1j}, and e_{ij} whereby e_{ij}captures the idiosyncratic shocks and $u_{0j} and\ u_{1j} X_{ij}$ capture the community covariate shocks. Specifically, u_{0j} captures the direct effect of covariate shocks affecting the intercept of each community and thus all households in the same community in the same manner, and $u_{1j} X_{ij}$ captures the indirect effect of covariate shocks. Equation (4a) may be rewritten as equation (4b) below whereby the term $u_{1j} X_{ij}$, the indirect effect of covariate shocks, introduces a random component (varying by j) to the coefficient of X_{ij}:

$$lnc_{ij} = \gamma_{00} + \gamma_{01} Z_j + (\gamma_{10} + u_{1j}) X_{ij} + \gamma_{11} Z_j X_{ij} + u_{0j} + e_{ij} \qquad (4b)$$

[8] A toolkit and a manual for the implementation of this two-level hierarchical model of consumption for the estimation of vulnerability to poverty based on cross-sectional data from other countries can be accessed at Equity Policy Lab – Intranet.

In the first stage, equation (4a) above is estimated using Stata's command for mixed-effects maximum likelihood regression. In the second stage, the squared residuals e_{ij}^2 and u_{0j}^2 and their squared sum $\left(u_{0j} + e_{ij}\right)^2$ from equation (4a) above may be regressed on X_{ij} and Z_j:

$$e_{ij}^2 = \theta_0 + \theta_1 Z_j + \theta_3 X_{ij} Z_j \quad (5a)$$

$$u_{0j}^2 = \tau_0 + \tau_1 Z_j \quad (5b)$$

$$\left(u_{0j} + e_{ij}\right)^2 = \pi_0 + \pi_1 Z_j + \pi_3 X_{ij} Z_j \quad (5c)$$

The estimated coefficients of equations (4a), (5a) (5b) and (5c) may then be used to estimate the expected mean an the expected idiosyncratic $\sigma_{e_{ij}}^2$, covariate $\sigma_{u_{0j}}^2$, and total $\sigma_{u_{0j}+e_{ij}}^2$ of a household's consumption based on the household's and the community's observed characteristics.

Assuming consumption is log-normally distributed, one can estimate the probability of consumption falling below the poverty line z and using a threshold for this probability (e.g. 50%) define who is vulnerable to poverty (i.e., a household is vulnerable if $\widehat{v_{ij}} \geq 0.5$).

$$\widehat{v_{ij}} = P\left(lnc_{ij} < lnz \mid X, Z\right) = \phi\left(\frac{lnz - \widehat{lnc_{ij}}}{\sqrt{\widehat{\sigma_{u_{0j}+e_{ij}}^2}}}\right) \quad (6)$$

Expression (6) can be used to derive an estimate of the vulnerability to poverty from covariate or woreda level shocks by replacing $\widehat{\sigma_{u_{0j}+e_{ij}}^2}$, in the denominator by $\widehat{\sigma_{u_{0j}}^2}$, while an estimate of the vulnerability to poverty from idiosyncratic shocks by using $\widehat{\sigma_{e_{ij}}^2}$ in place of $\widehat{\sigma_{u_{0j}+e_{ij}}^2}$.

The above steps are not sufficient to identify a vulnerable household, since all households have a nonzero probability of falling below the poverty line. The identification of the vulnerable households requires setting a threshold for the probability of being vulnerable to poverty. In the empirical literature, a household is classified as vulnerable if the household has a likelihood of being poor greater than or equal to 50% (i.e. falling below the poverty line at least once in the next two years).[9]

[9] The 0.5 probability threshold is justified in the following arguments provided by Pritchett *et al.* (2000, p. 5) and by Suryahadi and Sumarto (2003, p. 48): "First, this is the point where the expected consumption coincides with the poverty line. Second, it is intuitive to say a household is "vulnerable" if it faces at least 50% probability of falling into poverty. Third, if a household is just at the poverty line and faces a mean zero shock, then this household has a one period ahead

This is equivalent to saying that a household is considered vulnerable if the probability of falling below the poverty line in any given year is 29%.[10] Ultimately the choice of the threshold has an impact on who is considered vulnerable. As the threshold increases (decreases), and the required probability of falling under the poverty line increases (decreases), fewer (more) households are going to be identified as vulnerable.[11]

There are three important main caveats associated with the method that are important to bear in mind. First, the cross-sectional variance of consumption is assumed to approximate the intertemporal variance in consumption. Given that information on how household consumption varies due to shocks experienced over time is not available, the method assumes that the variability of household consumption over time can be approximated by how consumption at a given point in time varies across households with the same characteristics. The rationale behind this assumption is that differences in the consumption of households with the same characteristics at a given point in time is likely to be due to the different shocks experienced by these households. The extent to which this assumption is tenable or not can only be settled empirically by comparing the cross-sectional estimates of the variability of consumption among households with the same characteristics with the estimates of the variability of household consumption over time (and ideally with significantly more than the 2 or 3 survey rounds that could be found in short panel surveys). This issue will remain unsettled until a panel data set with multiple rounds sufficient for reliable estimation of household-specific consumption over time becomes available. Second, potentially large consumption measurement errors can overestimate consumption variance, especially from idiosyncratic shocks, which may in turn result in misleading vulnerability estimates. These estimates can be tested by carrying out simulations based on alternative measurement error assumptions (see Appendix Table A.3 in Gunther and Harttgen, 2009). Third, this model can shed light on generic "covariate" or "idiosyncratic" sources of vulnerability but cannot identify effects from specific shocks, such as a

vulnerability of 0.5. This implies that, in the limit, as the time horizon goes to zero, then being *in current poverty* and being *currently vulnerable to poverty* coincide."

[10] Let $P = Prob(\ln c_{ij} > lnz)$ denote the probability of being above the poverty line in any given year. Assuming the poverty status of a household is independent over time, the probability of being vulnerable to poverty at least once in the next 2 years, (i.e. using the 50% threshold), is then given by $v_{ij,t+2} = 1 - P^2 \geq 0.5$. Solving this for P yields $P = 0.71$ which implies that the probability of falling below the poverty line in any given year is 0.29 (=1-0.71).

[11] Take the extreme threshold of 0. This threshold implies that for a household to be considered non-vulnerable there cannot be a scenario under which the household would be below the poverty line. Although such threshold may seem desirable, it is impractical. For most households, there is always some small positive probability that they will fall below the poverty line and thus a threshold of 0 would in fact categorize every household as vulnerable. Such a categorization is not useful in identifying those with more immediate needs.

specific drought or flood. Nevertheless, the opportunity to assess the relative importance of idiosyncratic and covariate shocks in different regions of a country is particularly useful for determining insurance priorities and targeting social protection programs.[12]

4. Data

Data source and poverty measurement

The main sources of data used in this paper are the twinned Household Consumption Expenditure Survey (HCES) and the Welfare Monitoring Survey (WMS) of 2016. HCES and WMS are the official poverty and welfare monitoring surveys collected by the Central Statistics Agency (CSA) of Ethiopia every five years; HCES focuses on monetary welfare as measured by consumption expenditure while the WMS covers non-monetary welfare including education, health, access to services and exposure to various risks among other things. The two surveys cover the same sample households and the sample is large enough for sub-national analyses including at the regional level and urban and rural areas within a region. Coverage of pastoral areas of Afar and Somali was sparse until the 2016 survey round because in prior rounds the zones (administrative units below region) in Afar and Somali where pastoralists are prevalent were not included in the surveys. Therefore, the prior rounds of the surveys systematically under-represented pastoralists rendering them unsuitable for vulnerability analyses focusing on drought-prone and pastoral areas. In 2016 additonal zones were included in the HCES/WMS survey in Afar and Somali to increase the representativeness of the surveys to pastoral areas.[13]

Consumption expenditure includes both food and non-food items, regardless of whether these items are purchased on the market, come from own production, or were received as gifts. For own-consumption and gifts, the quantities consumed are valued at prevailing prices in the enumeration area. To capture the effect of seasonal variations, the data were collected over a 12-month span (Hamle 1 to Sene 30, i.e. July 8 to July 7), by randomly allocating sampled households to different

[12] Idiosyncratic shocks are, by definition, not correlated and more likely to be mutually insured within communities where information asymmetries and enforcement limitations may be smaller than across communities. On the other hand, covariate shocks that affect all households in a community more or less in the same manner are less likely to be insured by mutual insurance mechanisms *within* communities or even by mutual insurance mechanisms *across* communities.

[13] While the HCES/WMS sample covered only two administrative zones in Afar and three in Somali in 2011, it included five zones and eight zones respectively in Afar and Somali in 2016.

months. To adjust for price variations across time and space, spatial and temporal price deflators are used. Finally, to adjust for variations in household size and composition, consumption expenditure is divided by the officially used adult-equivalent scales, which are based on calorie requirements and vary by age and sex. The national poverty line, which is 7,184 birr per day per adult equivalent, is used. The poverty line is based on a food basket that is required to achieve the minimum daily calorie requirement – 2,200 kilocalories per adult in Ethiopia – and adjusted upwards to include non-food consumption.[14]

Descriptive statistics

A number of household and community (woreda) characteristics are included as explanatory variables in the two-level consumption estimation. The household variables include household size and composition, wealth quintile based on a wealth index created from ownership of selected consumer durables, household head characteristics, main livelihood of the household, a proxy for household capacity to cope with a shock and a dummy for rural households. The woreda level variables include average distance to an all-weather road, proportion of households who are engaged in agriculture, proportion of household heads with at least secondary education and average dietary diversity. The source of data for both household and woreda level variables are the HCES/WMS. While the household characteristics are taken from the surveys directly, woreda level variables are derived by taking the average for those households sampled from each woreda.

Table 1 presents the summary of the explanatory variables. The descriptive statistics show that households are large (with an average household size of 6.4) and most of them (82%) live in rural areas. Close to a quarter of the household heads are female while only 3 percent of the household heads have completed secondary education. The most common livelihood is agriculture while less than 10 percent of the households depend on salaried employment.

[14] FDRE (2012, 2017); Central Statistical Agency (2018).

Table 1. Descriptive statistics of explanatory variables

Household characteristics	Mean*
Household size	6.37 (2.30)
Number of household members under 15	3.47 (1.86)
Number of females 15 to 64	1.39 (0.83)
Number of household members 65 and older	0.13 (0.41)
Wealth quintile 1 (reference group)	
Wealth quintile 2	0.16
Wealth quintile 3	0.14
Wealth quintile 4	0.11
Wealth quintile 5	0.05
Head has at least secondary education	0.03
Head is female	0.24
Main livelihood: Salaried employment (reference group)	
Main livelihood: Daily laborer	0.04
Main livelihood: Agriculture	0.72
Main livelihood: Manufacturing, trade, services	0.12
Main livelihood: Pension, remittances, donations	0.04
Ability to raise 300 birr within a week	0.79
Rural household	0.82
Woreda level characteristics	
Average distance to road	16.58 (22.50)
% of households in agriculture	0.77 (0.27)
% of household heads employed	0.79 (0.15)
% of household heads with at least secondary school education	0.04 (0.09)
Average dietary diversity	4.32 (0.86)

*Standard deviations are provided in parenthesis for continuous variables.
Source: Author calculations from 2016 HCES/WMS.

5. Results and discussion

Regression results

The estimates for the consumption equation show that most of the coefficients are significant and with the expected signs. Household size, the number of children, the number of adult females, and the number of elderly are associated with lower consumption per capita. All wealth quintiles are associated with higher consumption compared to the first quintile though consumption does not necessarily increase with wealth in higher quintiles. Having a household head with at least a secondary education is associated with higher consumption while having a female household head is associated with lower consumption. Compared to those who primarily depend on salaried employment, those who depend on daily wage and agriculture have lower consumption while those who depend on transfers (pension, remittances, donations etc.) have higher consumption. Controlling for other characteristics, rural households have lower consumption than urban households. Woredas with a higher percentage of households involved in agriculture[15] and woredas where a greater number of household heads have at least a secondary education have higher consumption.

[15] This is unexpected given that agriculture is associated with lower welfare in general. But this refers to households with any form of agricultural activity and not necessarily fully depending on agriculture. Thus, urban agriculture is also reflected.

Table 2. Regression results: estimates of consumption equation (log consumption per capita)

Household characteristics	Coefficient	Standard error
Household size	-0.150***	0.004
Number of household members under 15	0.020***	0.004
Number of females 15 to 64	0.065***	0.009
Number of household members 65 and older	0.088*	0.047
Wealth quintile 1 (reference group)	ref.	
Wealth quintile 2	0.232***	0.018
Wealth quintile 3	0.228***	0.010
Wealth quintile 4	0.130**	0.055
Wealth quintile 5	0.283***	0.106
Head has at least secondary education	0.247**	0.108
Head is female	-0.096***	0.013
Main livelihood: Salaried employment (reference group)	ref.	
Main livelihood: Daily laborer	-0.180***	0.027
Main livelihood: Agriculture	-0.176*	0.091
Main livelihood: Manufacturing, trade, services	-0.024	0.084
Main livelihood: Pension, remittances, donations	0.106**	0.043
Ability to raise 300 birr within a week	0.056	0.085
Rural household	-0.229***	0.069
Woreda level characteristics		
Average distance to road	-0.001	0.001
% of households in agriculture	0.304***	0.082
% of household heads employed	-0.101	0.093
% of household heads with at least secondary school education	0.429*	0.227
Average dietary diversity	-0.009	0.022
$\widehat{\sigma^2_{e_{ij}}}$	0.122	
R sq for Level 1	0.402	
Obs. Level 1 (household)	30,141	
$\widehat{\sigma^2_{u_{0j}}}$	0.042	
R sq for Level 2	0.329	
Obs. Level 2 (community)	543	

Note: Interaction terms between woreda and a number of the household characteristics are also included in the regression but not reported.

*, ** and *** refer to statistical significance at 10%, 5% and 1% levels, respectively.

Source: Author calculations from 2016 HCES/WMS.

Poverty and vulnerability rates

Table 3 presents the estimates of the prevalence of poverty and vulnerability based on the two-stage regression by agroecological zone and region in Ethiopia in 2016. With 27 percent of the population in the drought-prone lowlands in poverty, the poverty level of the drought-prone lowlands is only modestly higher than the other ecological zones. Moisture-reliable lowlands have a poverty rate of 25 percent while the national poverty level is 23 percent. On the other hand, vulnerability in the drought-prone lowlands is noticeably higher than in the other ecological zones. While 58 percent of the population in the drought-prone lowlands is vulnerable to poverty, the rate of vulnerability for the moisture-reliable lowlands – the second most vulnerable ecological zone – is 38 percent. That is, in the event of a shock in the next two years, more than 50 percent of the population in drought-prone lowlands is vulnerable to falling below the poverty line. Nationally, the share is 38 percent. Furthermore, the vulnerability rate relative to the poverty rate is also highest in the drought-prone lowlands. In the drought-prone lowlands, the proportion of the vulnerable population is more than 2 times the proportion of the poor population (ratio of vulnerability rate to poverty rate is 2.1) while the second highest ratio is 1.6 (for the moisture-reliable highlands) and for the whole nation it is 1.7.

In terms of regions, Afar and Somali, which are fully drought-prone lowlands, are among the most vulnerable regions even if their poverty rates are not particularly elevated. With a vulnerability rate of 60 percent, Somali is the most vulnerable region followed by SNNP,[16] which is partly in the drought-prone lowlands, with a vulnerability rate of 46 percent. The vulnerability rate in Afar is 44 percent. Excluding the small and urban dominated regions of Harari and Dire Dawa with exceptionally low poverty rates, the ratio of vulnerability to poverty is also relatively higher in Afar and Somali. Somali has the highest vulnerability to poverty ratio (2.2) while the ratio for Afar is also among the highest (1.8). These are the regions where the poverty status is most misleading in terms of future likelihood of falling under the poverty line.

[16] SNNP refers to the Southern Nations and Nationalities and People region which has a small fraction (about 10% of the population) of drought-prone lowland area.

Table 3. Poverty and vulnerability rates for different group in 2016

		Vulnerability (%)	Poverty (%)	Ratio of vulnerability to poverty
Regions	Tigray	32	27	1.2
	Afar	44	24	1.9
	Amhara	28	26	1.1
	Oromia	40	24	1.7
	Somali	60	22	2.7
	Benishangul-Gumuz	36	26	1.4
	SNNP	46	21	2.2
	Gambella	42	23	1.8
	Harari	28	7	4.1
	Addis Ababa	9	17	0.6
	Dire Dawa	36	16	2.3
Ecological zones	Moisture-reliable highlands	36	23	1.5
	Drought-prone highlands	31	21	1.5
	Moisture-reliable lowlands	38	25	1.5
	Drought-prone lowlands	56	27	2.1
Urban/rural	Urban	17	15	1.1
	Rural	43	25	1.7
National		38	23	1.6

Source: Author calculations based on HCES/WMS, 2016.

Sources and types of vulnerability

As discussed above, vulnerability to poverty can be either poverty-induced (structural) which is driven by low average consumption of households (lower than the poverty line) or risk-induced (transitory) which is due to high consumption variability/volatility. The first two columns of Table 4 report the percentage of households that are poverty vulnerable and risk vulnerable, respectively. The results show that in the drought-prone lowlands, both poverty-induced and risk-induced vulnerability are higher than in the other agroecological zones. In the drought-prone lowlands poverty-induced vulnerability is relatively more important than risk induced vulnerability (ratio equal to 1.5) whereas in the other zones the ratio of poverty-induced vulnerability to risk-induced vulnerability is below one, suggesting that risk-induced vulnerability is more important. The ratios for Somali and Afar are 1.1 and 1.5, respectively. This attests to the unique nature of the drought-prone lowlands zone in comparison to the other agroecological zones and points in favor of policies and programs tailored specifically for the drought-prone lowlands. This is also consistent with the fact that the drought-prone lowlands lag in human capital indicators including education which are important determinants of welfare (World Bank, 2020).

It also possible to decompose the consumption variance due to idiosyncratic and covariate shocks. Columns four and five of Table 4 present the estimates of the percentage of households that would fall below the poverty line from an idiosyncratic shock and the percentage of households that would fall below the poverty line from a covariate shock. The estimates reveal that a higher share of the households are vulnerable due to either idiosyncratic shocks or covariate shocks in the drought-prone lowlands. Covariate shocks play a larger relative role in drought-prone lowlands than in the other agroecological zones.

Table 4. Source and type of vulnerability for different groups in 2016

		Poverty versus risk induced vulnerability			Idiosyncratic versus covariate vulnerability		
		Poverty induced	Risk induced	Ratio of Poverty-induced to Risk-induced	Covariate	Idiosyncratic	Ratio of Covariate to Idiosyncr.
Regions	Tigray	12	20	0.60	19	30	0.65
	Afar	23	21	1.09	29	43	0.67
	Amhara	9	19	0.48	14	27	0.53
	Oromia	20	20	1.03	26	39	0.68
	Somali	36	24	1.51	45	59	0.75
	Benishangul-Gumuz	16	19	0.84	23	34	0.68
	SNNP	22	24	0.95	31	45	0.68
	Gambella	24	17	1.40	30	41	0.73
	Harari	13	15	0.90	20	28	0.72
	Addis Ababa	3	6	0.50	4	9	0.48
	Dire Dawa	20	16	1.23	27	35	0.78
Ecological zones	Moisture-reliable highlands	16	20	0.82	22	35	0.64
	Drought-prone highlands	13	19	0.66	19	30	0.63
	Moisture-reliable lowlands	17	21	0.82	25	37	0.67
	Drought-prone lowlands	34	23	1.54	41	55	0.74
Urban - Rural	Urban	7	10	0.69	9	16	0.59
	Rural	21	22	0.92	28	42	0.67
National		18	20	0.90	24	37	o.66

Source: Author calculations based on HCES/WMS, 2016.

Vulnerability in the drought-prone lowlands: Rural versus urban areas

Table 5 presents the poverty and vulnerability estimates in the drought-prone lowlands for urban and rural areas separately. The results reveal substantial differences between urban and rural areas. The prevalence of both poverty and vulnerability is higher in the rural areas than in urban areas, a finding consistent with the prevailing belief that better access to infrastructure (e.g. roads, hospitals and schools) and markets is associated with reduced poverty and vulnerability to poverty. Moreover, in the rural areas the share of the population vulnerable to poverty is double the share of the population in poverty. In contrast, in the urban areas, the difference in the size of households in poverty and vulnerable to poverty is considerably smaller. (Ratio of the vulnerability rate to the poverty rate is 1.27.)

In the rural areas, poverty induced and risk-induced vulnerability are both significantly higher than in the urban areas, and low household assets and human capital endowments (or poverty-induced vulnerability) are relatively more important than consumption volatility (risk induced vulnerability). In urban areas, about half of those vulnerable are vulnerable due to endowments and half due to risk. Also, in the rural areas of the drought-prone lowlands, covariate shocks are found to have a relatively higher contribution to vulnerability than idiosyncratic shocks.

Broadly the same patterns emerge when comparing urban and rural areas in the Afar and Somali regions separately. In both regions, the ratio of vulnerability-to-poverty is higher in the rural areas than in the urban areas. In Afar the ratios are 1.94 to 1.33 and in Somali 2.82 to 2.04. Interestingly, even though rural Somali has a vulnerability rate that is 15 percentage points higher, the poverty rate is higher in urban Somali than in rural Somali, 24 percent to 22 percent, respectively. What is also evident is that Afar is better off in terms of vulnerability (and poverty) than Somali. In fact, a rural Afari has about the same probability of being below the poverty line and vulnerable to poverty as an urban Somali, suggesting that even within the drought-prone lowlands, there are substantial regional differences.

In both Afar and Somali, poverty-induced vulnerability and risk-induced vulnerability are both much higher in rural areas than in urban areas. Urban Afar differs from urban areas in Somali and other drought-prone areas in that consumption volatility is a more important source of vulnerability than household endowments. In the other urban areas, low household assets and human capital endowments (or poverty-induced vulnerability) are relatively more important than consumption

volatility (risk-induced vulnerability). Lastly, in comparison to the urban areas, in the rural areas of both Afar and Somali**,** covariate shocks have a bigger impact on household vulnerability relative to idiosyncratic shocks.

Table 5. Poverty and vulnerability rates in urban and rural drought-prone lowlands

		Drought-prone lowlands		Afar		Somali	
		Urban	Rural	Urban	Rural	Urban	Rural
Poverty and vulnerability	Vulnerability rate (%)	28	63	15	51	48	63
	Poverty rate (%)	15	29	11	26	24	22
	Ratio (V/P)	1.84	2.13	1.33	1.94	2.04	2.82
Poverty- versus risk-induced vulnerability	Poverty induced	14	38	6	27	26	38
	Risk induced	14	25	9	24	22	24
	Ratio (P/R)	1.07	1.54	0.74	1.12	1.16	1.57
Idiosyncratic versus covariate vulnerability	Covariate	18	46	9	33	32	47
	Idiosyncratic	26	62	15	49	46	62
	Ratio (C/I)	0.7	0.75	0.59	0.68	0.7	0.76

Source: Author calculations based on HCES/WMS, 2016.

6. Conclusion

Using the 2016 HCES/WMS data, we estimated vulnerability to poverty in the drought-prone lowlands of Ethiopia relative to other ecological zones using a two-level hierarchical regression model that includes both idiosyncratic (household level) and covariate (community level) variables. We found that vulnerability to poverty is remarkably higher in the drought-prone lowlands than in the other ecological zones (56 percent vulnerability rate for the drought-prone lowlands versus 38 percent for the whole country). The ratio of vulnerability rate to poverty rate is also significantly higher in the drought-prone lowlands – 2.1 in the drought-prone lowlands versus 1.6 in the whole nation. Furthermore, the analysis reveals important differences in the nature of vulnerability between the drought-prone lowlands and the other ecological zones including that in the lowlands: (i) though the vulnerability rate due to covariate shocks is lower than vulnerability due to idiosyncratic shocks in absolute terms, the relative importance of covariate shocks is higher in the drought-prone lowlands than in the other ecological zones; and (ii) while both poverty induced (vulnerability due to low

average consumption) and risk induced (vulnerability due to high consumption variability) vulnerabilities are higher in the drought-prone lowlands, the relative importance of poverty induced vulnerability is higher in the drought-prone lowlands than in other ecological zones – the ratio of poverty induced vulnerability to risk induced vulnerability is 1.5 in the drought prone lowlands as opposed to 0.9 for the whole country. In the drought-prone lowlands, shocks such as droughts combined with low human and livestock capital are major sources of vulnerability to poverty for households. This points to the need for policies and programs in the drought-prone lowlands tailored at alleviating vulnerability to poverty and not just poverty per se.

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Annex 1. Ethiopia's 4 Agro-Ecological Zones