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Vulnerability to Drought and Food Price Shocks: Evidence from Ethiopia

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Summary. — While the measurement and determinants of poverty have been widely studied, vulnerability, or the threat of future poverty, has been more difficult to investigate due to data paucity. We combine nationally representative household data with objective drought and price information to quantify and investigate causes of vulnerability to poverty in Ethiopia. Previous estimates have relied on self-reported shocks and variation in outcomes within a survey, which is inadequate for shocks such as weather and prices that vary more across time than space. We used historical distributions of climate and price shocks in each district to simulate the probable distribution of future consumption for individual households and use these quantify vulnerability to poverty. We find that many Ethiopians are unable to protect their consumption against lack of rainfall and sudden increases in food prices. A moderate drought causes a 9% reduction in consumption for many rural households and recent high inflation has caused a 14% reduction in the consumption of uneducated households in urban areas. We also find that the vulnerability of rural households is considerably higher than that of urban households, despite realized poverty rates being fairly similar. This reflects the fact that the household survey in 2011 was conducted during a year of good rainfall but rapid food price inflation. The results highlight the need for caution in using a snapshot of poverty to target programs, as underlying rates of vulnerability can be quite different from the poverty rate captured at one point in time. The results also suggest that significant welfare gains can be made from risk management in both rural and urban areas.

Key words — vulnerability, poverty, drought, inflation, Ethiopia

1. INTRODUCTION

Households in developing countries face significant uncertainty about their future consumption. There are many sources of this uncertainty, for example job insecurity, ill health that affects the productive labor and income of a household, death of family members, drought that reduces crop yields and incomes and, more recently, price shocks that make purchasing basic food supplies more difficult for those with few resources.

The importance of risk for decision making and the consequences of realized shocks have become an ever-more important focus for policymakers as evidenced by the World Development Reports of 2001 and 2014 (World Bank, 2014). The increasing availability of data on shocks, particularly those that are experienced by entire communities at once (such as weather shocks and price shocks), allow for better estimates of the welfare impact of shocks. It also allows for new forward-looking quantitative research on the intersection of poverty and risk.

It is to this literature that this paper aims to add, by applying and extending lessons from both theoretical and empirical work on shocks and vulnerability to a newly compiled dataset that is nationally representative, and used to calculate official estimates of poverty. [1] The methodology we use is of general interest, as it combines several new ideas for estimating the impact of rainfall and price shocks on welfare using cross-sectional data, and combining these estimates with long-run data on rainfall and prices to generate estimates of household vulnerability. While the availability of panel data surveys is improving for developing countries, they are not yet widespread, often are small in size, and not nationally representative. Vulnerability estimates have either relied on self-reported shocks and short, unrepresentative panel surveys (Calvo & Dercon, 2013; Klasen, Lechtenfeld, & Povel, 2015), or on the cross-sectional distribution of consumption (Chaudhuri, 2003), neither of which are completely satisfactory. We show that measures of vulnerability that properly take covariate shocks into account can result in a very different understanding of welfare differences across groups than poverty measures at one point in time. This highlights the importance of considering such measures of vulnerability when designing poverty-targeted programs in many African countries where poverty is infrequently measured and covariate shocks are important.

Economists have recently incorporated rainfall data as exogenous sources of shocks in various empirical models to estimate ex-post impacts of weather (Dell, Jones, & Olken, 2014). The impact of weather shocks on consumption outcomes for households has been analyzed in this way for a small sample of villages in rural Ethiopia by among others (Dercon, 2004; Dercon & Krishnan, 2000; Porter, 2012), and similarly food price shocks in urban areas have been analyzed using a household panel by Alem and Söderbom (2012). In this paper we quantify the welfare impact of drought and price inflation at a national level in Ethiopia. We use community (woreda)-level information on rainfall-induced crop-losses as the objective measure of rainfall shocks and control for the probability of drought in a given community using the historic distribution of drought. Conditional on the probability of drought, the timing of the shock is considered to be exogenous. Other unobserved geographic characteristics are controlled for by the inclusion of district (zone) fixed effects. [2]

In addition, to date, no study has used the historical distribution of covariate shocks to estimate the distribution of future consumption and poverty. Existing studies rely instead on cross-sectional variation in shocks which does not accu-

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rately take into account the welfare volatility that arises from events that vary more across time than space. We combine time-series information on rainfall-induced crop losses at the community level with the estimated impact of rainfall losses on consumption to predict future consumption (in combination with similar estimates of the impact of price shocks and idiosyncratic shocks). Using the estimated probability distribution of future consumption we calculate national estimates of vulnerability to poverty and also illustrate differences in vulnerability to poverty between groups such as urban and rural, or by geographic status (though with caveats around the meaning of "vulnerability" discussed below).

There are four reasons why we may consider Ethiopia a pertinent case study for a focus on vulnerability. First, the Ethiopian economy is still largely comprised of rain-fed agriculture in an agroclimatic environment that has been no stranger to extreme drought in recent decades. Vulnerability to weather risk has historically been very high among agricultural subsistence farmers, which describes the majority of Ethiopian rural households. Almost half of rural households in Ethiopia were affected by drought in a five-year period from 1999 to 2004 (Dercon, Hoddinott, & Woldehanna, 2005). Although drought has been less prevalent in the last decade than the previous two, the underlying climate risk remains unchanged and could worsen with climate change (Robinson, Strzepek, & Cervigni, 2013).

Second, poverty in Ethiopia has fallen considerably in the last decade as a result of successive years of good harvests and economic growth (World Bank, 2014). This positive change has resulted in many individuals with per capita consumption now just above the national poverty line. These now non-poor individuals are likely still exposed to considerable risk, and could be vulnerable to falling back into poverty (Devarajan, Go, Maliszewska, Osorio-Rodarte, & Timmer, 2013). However, it is possible that the growth experienced by Ethiopian households has made them both less poor and more resilient, and an empirical assessment is needed to determine the degree of vulnerability to poverty that is present in Ethiopia today.

Third, a large safety-net program was introduced between the two surveys used in the analysis, covering rural areas using geographical targeting. In 2005, the Government of Ethiopia introduced the Productive Safety Net Program (PSNP) in an attempt to transition food insecure households from an emergency food aid system to a more stable and predictable safety net.[3] The program tackles chronic poverty, but also aims to protect beneficiaries and non-beneficiaries against drought. We can assess the impact of shocks on those covered by the program and comment on targeting. Finally, Ethiopia suffered from very high food price inflation during one of the survey years, providing insights into other low-income countries with increasing urban populations that have been similarly affected by high food price inflation in recent years.

To preview our findings, we show that shocks do have a significant impact on the consumption of households in Ethiopia, with rainfall shortfalls and food price increases being the most important. A moderate drought reduces consumption by 9% for many rural households in drought-prone areas and the rapid inflation witnessed in the first half of 2011 caused consumption losses up to 14% among many urban households. We find considerable heterogeneity of impacts, with uneducated households in urban areas suffering most from food price increases and those not covered by the safety net in rural areas suffering most from rainfall losses.[4] When covered by the safety net, beneficiaries are better able to withstand shocks than non-beneficiaries, although this cannot be fully attributed to the presence of the program.

Vulnerability to poverty using our approach is 42% in rural areas, much higher than poverty (headcount just under 30%); while vulnerability is five percentage points less prevalent than poverty in urban areas. This is on account of poverty having been measured in a year of good conditions in rural areas (good weather) and bad conditions in urban areas (high food price inflation). It highlights how a one-year snapshot of poverty such as afforded by a national consumption survey is not necessarily reflective of the relative vulnerability of different groups in the population, and also, that drought and inflation do not always coincide. Analyzing our various vulnerability measures by gender of the household head yields surprising results: While female-headed households are more vulnerable in urban areas, the opposite is true in rural areas. PSNP targeting in rural areas appears to be good, but there are many households in rural woredas that are not covered by the program, and many vulnerable households in urban areas too.

The paper is structured as follows. Section 2 outlines the empirical method and data used to estimate the impact of weather and price shocks on household consumption. Section 3 discusses the literature on vulnerability measurement and how the estimated impact of weather and prices on consumption can be used to measure vulnerability to poverty. Section 4 presents results on the impact of weather and prices on consumption. Section 5 presents vulnerability estimates for 2011, with a breakdown by location and gender. Section 6 concludes with some policy recommendations.

2. QUANTIFYING THE WELFARE IMPACT OF WEATHER AND PRICE SHOCKS

(a) *Methods*

A particular focus of the methodology employed in this paper is in identifying an internally consistent estimate of the welfare losses caused by shocks.

The welfare measure used is that used by the Government of Ethiopia in estimating poverty, namely total expenditure on food and non-food consumption per adult equivalent (Woldehanna & Porter, 2013). The setting in which the household operates (the economic, legal, and political environment) and the household's ability to cope with shocks determines how shocks impact consumption such that consumption can be given by:

$$\ln C_{hjkt} = X_{hjkt}\beta + S_{hjkt}\delta + S_{hjkt} * X'_{hjkt}\gamma + \mu_h + \eta_j + \lambda_k + \psi_t + \epsilon_{hjkt} \quad (1)$$

A household h resides in community (woreda) j within district (zone) k at time t. Our explanatory variables are included in a vector X, comprising household and community characteristics; and S is a vector comprising both idiosyncratic shocks (experienced by an individual household, or an individual within a household), and covariate or aggregate shocks (which affect a whole village, region, or possibly even the whole country). Time fixed effects, ψ_t, district fixed effects λ_k, woreda fixed effects η_j, and household fixed effects μ_h are unobserved.

Individuals for whom a shock S has had a large negative impact are possibly more likely to report its occurrence than individuals who could mitigate the effects, thus calling into question the assumption of exogeneity when S is measured

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