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World Development Vol. 64, pp. 181–193, 2014

http://dx.doi.org/10.1016/j.worlddev.2014.05.028

Rainfall Shocks and Within-Community Wealth Inequality: Evidence from Rural Ethiopia

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Summary. — Household-level impacts of environmental shocks are often negative, but may vary considerably due to heterogeneous vulnerability. This paper considers how differential vulnerability among households affects inequality within rural communities in Ethiopia. This study makes novel use of the Demographic and Health Surveys (DHS) and a NASA agro-climatology dataset. Results show that rainfall deficits have an equalizing effect on within-community livestock inequality in parts of Ethiopia, but regional differences are observed. A non-significant effect is observed with respect to asset inequality. As an initial study on this topic, this paper outlines an agenda for future data collection and analysis efforts.

Key words — environmental shocks, inequality, vulnerability, natural experiment, Ethiopia, African development

1. INTRODUCTION

Environmental shocks routinely threaten the livelihoods of poor and excluded households across the developing world. Evidence suggests that these shocks are often associated with decreased expenditures, reduced food consumption, distress sales of productive assets, and out-migration—all of which may undermine a household's long-term welfare and social standing in its community (Dercon, Hoddinott, & Woldehanna, 2005; Gray & Mueller, 2012a; Hoddinott, 2006; Hoddinott & Kinsey, 2001; Little, Stone, Mogues, Castro, & Negatu, 2006). In some cases, however, the magnitude and likelihood of these negative impacts has been shown to vary within affected populations, and certain actors may even gain from such crises by exploiting the vulnerable or benefitting from changes in relative prices (De Waal, 2005; Watts, 2013). These heterogeneous impacts reflect systematic differences in vulnerability, which is a function of a given household's exposure to the shock and its ability to cope without compromising its long-term economic and social status (Bohle, Downing, & Watts, 1994; Chambers, 2006; Watts & Bohle, 1993).

Assuming that vulnerability does indeed vary within communities, households should experience differential changes in outcomes affected by a given shock (e.g., asset sales, odds of out-migration). Such heterogeneous effects will, by definition, change the relative status, or distribution of affected households with respect to that outcome(s). Despite this seemingly straightforward expectation, no existing research has examined the impact of environmental shocks on social and economic inequality *within communities*. These places are key loci of social and economic activity, and sites of many processes that produce, reproduce, and change inequality. Previous studies of how environmental shocks affect household-level outcomes and shape between-household inequality across larger geographic spaces provide hypothesis-generating insights, but ultimately cannot answer the empirical question of how heterogeneous outcomes at the micro-level contribute to changes in aggregate within-community inequality.

This question represents a knowledge gap at the intersection of a set of relatively recent quantitative studies of social and economic responses to environmental change (e.g., Carter, Little, Mogues, & Negatu, 2007; Gray & Mueller, 2012b; Gray & Bilsborrow, 2013; Little *et al.*, 2006), a body of rich theoretical work on vulnerability (e.g., Watts & Bohle, 1993; Wisner, Blaikie, Cannon, & Davis, 2004), and an extensive social science literature on inequality and differentiation (e.g., Grusky, Ku, & Szelenyi, 2008; Gray & Dowd-Uribe, 2013). Answers to this question may also have practical implications, since the distribution of resources within communities has been shown to affect a number of individual-, household-, and community-level outcomes that are important in their own right, and may have implications for vulnerability to future shocks (Adger, 2000; Berry, 1989; Cleaver, 2005; Mogues, 2006; Woolcock, 1998).

Here, I address this knowledge gap by examining the relationship between rainfall deficits and asset inequality within rural Ethiopian communities. Rural Ethiopia is a particularly compelling site to study this issue. The size and share of the Ethiopian population living in rural areas (62.1 million, 84% in 2007) is among the largest in the world (Ringheim, Teller, & Sines, 2009). A large majority of this rural population is dependent upon low-input, rain-fed agriculture for food and income; rural livelihoods and weather conditions are closely linked. Given this social context and the relatively high frequency at which rainfall shocks affect the Ethiopian countryside, such weather events are arguably among the key challenges to sustainable development in the country (Devereax,

* This research is part of a project supported by Cornell University's Food Systems and Poverty Reduction IGERT program, the Cornell Graduate School, the Rural Sociological Society, and CARE-Ethiopia. Thanks to David Brown, Chris Barrett, Dan Lichter, Max Pfeffer, Tim Gorman, Joseph Ross, Scott Sanders, Richard Turner, and seminar participants at LSU's Department of Sociology and the GWU Institute for Global and International Studies for their feedback on initial drafts of this paper. I would also like to thank James Hoell for his invaluable assistance accessing the NASA POWER data, and Editor Agrawal and two anonymous reviewers for very constructive feedback on the original manuscript. Responsibility for all remaining errors is mine alone. Final revision accepted: May 23, 2014.

2000; Little *et al.*, 2006). Additional knowledge on this topic may inform policy and program innovations among the many government and non-governmental actors that play an active role in rural development in Ethiopia.

This study's community-level approach offers a new perspective on the social and economic impacts of weather shocks in the Ethiopian context. Drawing upon data from the 2005 and 2011 Ethiopian Demographic and Health Surveys (EHDS) and an agro-climatology dataset developed by NASA, I estimate the effect of rainfall deficits on within-community asset and livestock inequality. Given the lack of previous research on this topic, I also place considerable emphasis on methodological and measurement issues that future research on this topic must engage with. The paper proceeds as follows. The next section reviews the existing literature. I then describe the data, measurement approach, and analytic strategy before presenting the results. I conclude by discussing the results and outlining directions for future research.

2. PREVIOUS RESEARCH

Despite a substantial literature examining the often-adverse impacts of environmental shocks on rural households, less is known about how the effect of such events varies across households, and by extension affects inequality in shock-affected communities. Existing studies addressed the relationship between environmental shocks and within-community inequality only tangentially, providing useful insights for developing hypotheses but leaving significant gaps in evidence.

Reardon and Taylor (1996) found that exposure to drought was associated with equalization of household incomes within an affected agro-climatic zone in Burkina Faso. They showed that much of this observed change was due to livestock sales among the poor in drought-affected areas, which offset inequality-increasing changes in crop sales and migration income. Valentine (1993) found that exposure to drought was associated with only trivial changes in income inequality among households across rural Botswana. Like Reardon and Taylor, however, Valentine reported that drought was associated with significant changes in the composition of household income. Both studies showed that multiple and potentially offsetting processes (e.g., livestock sales, migration, and remittances) may underlie drought-related changes in income inequality. While many of these processes (e.g., livestock sales) have different implications for asset wealth than for income, these findings nonetheless demonstrate that changes in inequality may reflect processes of both asset loss and wealth or income accumulation (see also Watts, 2013). However, both studies are limited by weak or nonexistent controls for potentially confounding changes within the drought-affected areas. These analyses also measure between-household inequality across large geographic units (e.g., agro-climatic zones, rural areas) that are quite remote from the spaces in which rural households live and where most exchange between households takes place. Additionally, environmental conditions are likely to vary within larger spatial units, making it difficult to measure exposure to shocks.

Despite these methodological limitations, Reardon and Taylor and Valentine's findings about the changing composition of income sources in drought-affected contexts are consistent with other literature on household responses to environmental crisis. Corbett (1988) and De Waal (2005) documented activities that commonly occur as a part of these strategies, including: formal and informal borrowing and transfer arrangements; changes in agricultural practices; out-migration of various durations; livelihood diversification; livestock sales; and decreased food consumption. Many of these activities have consequences for households' asset stocks. [1] On the one hand, consumption smoothing behaviors involve liquidating assets or forgoing opportunities to accumulate assets in order to maintain adequate levels of food consumption (Morduch, 1995). On the other hand, households may engage in conservative asset smoothing behaviors that entail sacrificing current consumption to protect existing asset stocks, which may be necessary to avoid complete dispossession or deal with expected future shocks in high-risk environments (Barrett & Carter, 2013; Carter & Lybbert, 2012; De Waal, 2005; Hampshire, Casiday, Kilpatrick, & Panter-Brick, 2009; Zimmerman & Carter, 2003). A number of other responses, such as out-migration of household members, may affect asset stores indirectly by reducing demand for resources among household members (Ezra, 2001). [2]

Ethnographic research has shown that the particular set and timing of coping strategies employed by households in drought-affected contexts is contingent upon a multiplicity of social, economic, and ecological conditions (De Waal, 2005). Without dismissing these complexities, quantitative research has shown that certain types of households tend to engage in certain strategies—or experience certain outcomes—more than others. For example, Dercon *et al.* (2005) found that drought had a significant negative effect on consumption levels among rural Ethiopian households during 1999–2004. [3] These impacts varied systematically with households' social and economic statuses: female-headed households, households headed by individuals without formal education, and relatively land-poor households experienced greater drought-related declines in consumption than others. The relatively large impact among these vulnerable populations may reflect a higher propensity to sacrifice consumption to protect assets among lower status households, who may have fewer assets to buffer against future shocks. These households may also simply lack assets to sell off or exchange for other goods. Such hypothesized behavior is consistent with the findings of Hoddinott (2006), who showed that rural Zimbabwean households with low levels of assets prior a shock were more likely to reduce food consumption than liquidate assets needed to maintain pre-shock consumption levels. [4]

Little *et al.* (2006) also found evidence that households with relatively high levels of assets (*ex ante*) were more likely to experience shock-related decreases in assets than those with few assets. They find that many Ethiopian households classified as poor prior to a drought maintained or even accumulated assets during and after it, often by reducing consumption and engaging in wage labor or petty trade. In contrast, wealthier households experienced large proportional declines in their assets, which may reflect their relatively high levels of exposure and their ability to sell assets for food without endangering their long-term social and economic standing (i.e., falling into poverty traps). Moreover, these wealthy households were able to recover many of their assets in subsequent months by taking advantage of a favorable post-drought livestock market, promoting natural herd reproduction, and engaging in exploitative herd-sharing contracts with the poor. The post-shock trajectory of the poor was relatively flat in comparison. [5]

Existing research has also shown that environmental shocks affect migration. Mobility among individuals and households may in turn shape wealth inequality in communities if migration—or remittances from migrants—occurs disproportionately among particular social groups. Gray and Mueller (2012a) found that exposure to drought was associated with