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Ex-Ante Risk Management and Implications for Sustainable Poverty Reduction

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Introduction

The recent global financial crisis, and the food and fuel price increases in 2008-2009, unfolding in the context of increasing concern and awareness about the negative impacts of climate change on the poor have highlighted the fragility of progress in the fight against global poverty. These crises together with the apparent slowdown in growth globally reveal that progress in poverty reduction and shared prosperity may be easily undermined by the high levels of vulnerability prevalent in many developing countries. Economic crises and price shocks aside, the incidence of natural disasters, extreme weather events and climate change-related shocks, civil conflicts, crime and violence, health shocks and illnesses, infectious diseases and pandemics may also contribute separately and sometimes in unison, to pushing the vulnerable households below the poverty line, and the poor into deeper poverty. Depending on the ability of households to protect themselves through formal or informal arrangements, and the capacity of existing social safety net programs (when available) to expand coverage to the "new" poor in times of need, the impacts of such covariate and idiosyncratic shocks on poverty may be large, and associated with potentially severe and long-lasting negative effects in human development.

The increased appreciation of vulnerability as a potential threat to the sustainability of poverty reduction efforts has led to renewed interest among policymakers in risk management systems.[1] Disaster risk financing and insurance (DRFI) strategies are at the core of efforts to allow governments of developing countries to cope with weather shocks, natural disasters and other shocks in a rapid, predictable, and cost effective fashion.

The purpose of the two papers summarized in this brief is to reinforce the point that DRFI strategies are important not only for protecting household welfare from covariate and idiosyncratic shocks but also for fostering economic growth, and maintaining social stability. We argue that neglecting to take this properly into account, and valuing DRFI solely based on the impact of disasters on welfare when they occur, will result in a systematic under-estimation of the value of DRFI strategies for reducing poverty.

In a risky environment and in the absence of finance and insurance markets, people typically resort to self-insurance strategies whereby they use their productive assets in low-risk low-return activities that guarantee survival and a minimum level of consumption independently

[1] Risk management, is the process of confronting risks, preparing for them (ex-ante), and coping with their effects (ex-post). The goal of risk management is to increase the capacity to prepare for and deal with risk, and increase resilience to negative shocks (ability to cope with shocks). A risk management system refers to the set of institutions and programs such as early warning systems, safety nets and social transfers, as well as the increased availability and utilization of index-based risk transfer instruments all aimed at facilitating risk management in the target population.

of the extent and intensity of the realized shock.[2] These actions minimize the negative impacts of the shocks if and when such shocks materialize and have important consequences that tend to be underappreciated. In the aftermath of a shock, self-insured households are likely to appear as more "resilient" than other households in the sense that the shock may have a smaller impact on their asset holdings and welfare, and their speed of recovery to the pre-shock level of assets and welfare faster. In addition, irrespective of whether a shock is realized or not, low-risk, low-returns strategies come at a cost in the sense that they have long-lasting negative effects on human development as well as on the accumulation of physical capital (investment) and growth. The emerging literature on poverty traps and chronic poverty underscore the relationship between risk and chronic poverty as well as the potential offered by innovations in risk management.[3]

The papers summarized in this brief quantify the impact of uninsured risk on income growth using two commonly used econometric methods in two geographically distinct settings. The first paper uses observational data to quantify the impact of uninsured risk on household occupational choice in rural India and the implications of this for poverty reduction. The second paper uses experimental data—the randomized introduction of insurance—to quantify the impact of uninsured risk on smallholder investment in agriculture in the Sahel. Both papers contribute to an extant literature on the use of these method to examine the costs of uninsured risk.

Occupational choice in rural India

The first paper "Occupational Diversification as an Adaptation to Rainfall Variability in Rural India" investigates occupational diversification among household members in rural India as an adaptation strategy against the risks arising from the historical variability of local rainfall. Households in poor rural economies, where weather-related risks are prevalent and credit and insurance markets are absent, may adapt through precautionary and reactive actions protecting their welfare, but at the cost of lower returns (e.g., Morduch, 1995; Rosenzweig & Binswanger, 1993; Dercon 2003, 2004). Such conservative portfolio choices and low-risk low-return strategies for the use of productive assets may reduce the likelihood that households accumulate the assets needed to escape poverty through their own savings and investment (Rosenzweig & Wolpin, 1993; Morduch, 1995; Carter and Barrett, 2006, 2013). Recent studies suggest that the effect of risk in the absence of effective formal insurance and credit markets is very important for investment and growth. Elbers et al., (2007), for example, estimate that households in Zimbabwe would accumulate much more capital in the absence of risk (46% lower than in the absence of risk) and that the total effect of risk is dominated by the *ex-ante* effect. In contrast, the *ex-post* impact of shocks appears to be less important. In such contexts, identification of the ways in which government actions and policies can remove constraints to adaptation, facilitate the process of adaptation as well as minimize the negative consequences of adaptation is essential.

Motivated by these considerations, this study investigates household adaptation to the historical variation in local rainfall in terms of the employment and occupational selection of the members of households in rural India. With approximately 70 percent of India's population living in rural areas in 2010, and about 58 percent of the total numbers of workers employed in the agricultural sector, local rainfall variability during the monsoon season comprises the primary source of production and income risks. The sector of employment of the millions of rural households in India as well as

[2] Even if these markets are present, problems like moral hazard and adverse selection may limit the benefits from risk sharing.

[3] The assets based approach to risk and chronic poverty is outlined in Carter and Barrett, (2006 and 2013). Barrett, et al. (2008) explore the implications of these ideas on the design of safety net programs, while Kraay and McKenzie (2014) provide an up to date assessment of the empirical evidence available on the existence of poverty traps.

many other developing countries is an important determinant of household welfare. Considering that there is a variety of factors involved in the decision of households to allocate labor between agricultural and non-agricultural occupations (on-farm and off farm), it is important to establish empirically the extent to which occupational diversification among household members represents an adaptation to the historic climatic variability as opposed to "pull" factors such as expanded opportunities to earn higher wage rates in other sectors. In principle, household members could also specialize by working in the same occupation or sector and increase productivity by learning from each other's experience (Menon & Subramanian, 2008; Shenoy, 2013). However, lack of access to credit and capital, and the presence of idiosyncratic and uninsured risks may "push" rural households and their members away from specializing in the agricultural sector to diversified activities off the farm (Lanjouw & Lanjouw, 2001). For example, Deininger & Olinto (2001), demonstrate in rural Colombia, that although households stand to gain by choosing a single specialized farm-based source of income, they choose to diversify into non-farm economic activities to reduce risks. Thus, at the household level, occupational diversification may result in more income security but at the cost of a lower level of welfare and overall growth.[4]

Much of the empirical literature in developing economies is concerned with the impacts of extreme weather events on key welfare outcomes.[5] Yet, these studies can only provide indirect inferences about the relationship between climatic norms and adaptation as measured by the prevalence of occupational diversification, other common practices among households, or the prevalence of social institutions and customs. Empirical studies shedding direct light and evidence on the relationship between climatic norms and adaptation are quite scarce. Rosenzweig and Stark (1989), for example, provide one of the early empirical studies on the role of marriage of daughters to locationally distant, dispersed yet kinship-related households, as an adaptation strategy facilitating consumption smoothing in an environment characterized by information costs and spatially covariant risks. They find that marriage with migration contributes significantly to a reduction in the variability of household food consumption, and that farm households afflicted with more variable profits tend to engage in longer-distance marriage with migration. However, the external validity of this study regarding adaptation behavior in the context of a changing climate is limited by the specificity of the sample used (a small 10 year panel of households from only 6 villages of semi-arid India).

The current study complements related studies (Menon, 2009, Ito & Kurosaki, 2009, and Bandyopadhyay & Skoufias, 2013) in two ways. First, this study covers all of rural India which is characterized by diverse agro-ecological zones, different levels of rural infrastructure as well as a tremendous variation in climate, ranging from the desert-like western Rajasthan to the moist eastern foothills of the Himalaya to the tropical south. The studies above either covered less heterogeneous countries with specific features such as mountainous Nepal (Menon, 2009) and flood prone Bangladesh (Bandyopadhyay & Skoufias (2013), or a couple of northern states of India with relatively homogenous agro-ecological features (Ito & Kurosaki, 2009). Second, this paper carries out a more systematic investigation of the extent to which government investments in various types of rural infrastructure such as irrigation, roads, and information and communication,

[4] Households may also self-insure against weather risks by "saving for the rainy day." However, savings for self-insurance as opposed to investment in productive capital also hinders growth.

[5] For example, see Mueller and Osgood (2009) on the impacts of droughts on income and wages in Brazil, and the literature on consumption smoothing through precautionary savings, conservative cropping choices, and intra-household risk sharing (Dercon S. , 1996; Dercon & Krishnan, 2000; Dercon & Hoddinott, 2003).

or credit services or education can facilitate household adaptation to increased risks due to climatic change.[6]

A variety of data sources are merged together for the purpose of this analysis. These data sources include household survey data from National Sample Survey (NSS), Indian National Sample Survey (NSS59: Schedule 18.2 collected in 2002-2003) district level data on topography from the Food and Agriculture Organization (FAO) data, infrastructure from the Indian Village Census, and daily rainfall data from the India Meteorological Department. The analysis also employs, high resolution gridded (on 1 degree latitude by 1 degree longitude cells) daily rainfall data from the India Meteorological Department (IMD) covering the years 1951 to 2003 based on daily records from more than 1800 weather stations. Normal (i.e. mean) precipitation and normal variability, as measured by the coefficient of variation (the ratio of the standard deviation to the mean rainfall in each district) during the 1960-2000 period for a district are interpolated from the 296 cells covering India.

The occupational choices of working non-head members are based on both pull and push factors. As noted above the main sources of push factors in rural India is local variability of rainfall. Thus, it is hypothesized that in districts where the variance of rainfall is high, household members other than the head of household are more likely to choose occupations unrelated to agriculture. Similarly, in districts where the variance of rainfall is high, the head and other members of the household may diversify between self and wage employment in agriculture.

The analysis reveals that high rainfall variability has a significant negative effect on the agricultural specialization within-household occupational choices. This confirms the hypothesis that local variability in rainfall "pushes" household members towards employment in non-agricultural sector. Data limitations do not allow the measurement of the extent to which being pushed out of agriculture affects household welfare or wage and non-wage earnings. However, the strong correlations between local rainfall variability and intra-household sectorial diversity points towards the predominance of the *ex ante* "push" factor rather than the "pull" of higher potential earnings in the non-agricultural sectors driving the agricultural household members to choose non-agricultural employments and likely lower household earnings for those exposed to this *ex ante* risk.

To a large extent this finding is reinforced by the results of the more systematic investigation of the extent to which government investments in various types of rural infrastructure can facilitate household adaptation to increased risks due to climatic change. Policies that improve access to education, credit, roads, and information, such as postal services, have two kinds of potential effects. First, better access to education, markets, and information may make agriculture more productive, and thus reduce the need for seeking low return non-agricultural activities for the purpose of minimizing *ex ante* rainfall risks. If this is the predominant channel through which access to education, information, and markets, affects intra-household employment choices, one would expect households with access to these services to be more specialized in agriculture. On the other hand access to the same set of services, namely, education, information, and markets, also allows employment in high-return non-agricultural sectors. If access to these services predominantly extends the "pull" of high-returns non-agricultural activities, then one would expect the combination of high *ex ante* rainfall risks and access to education, information, and markets, to reduce the household specialization in agriculture. Given that the results are not always robust across specifications, it is not possible to determine with certainty

[6] This line of work is very much in line with Smit, et al. (2000) who point out that adaptations vary not only with respect to their climatic stimuli but also with respect to other non-climate conditions sometimes called intervening conditions, which serve to influence the nature and sensitivity of the adjustments taking place.

whether access to these services diminishes the "push" *ex ante* rainfall risks or increases the "pull" of high-return non-agricultural employments. In either case, the agricultural households are likely to gain from a higher level of access to these services.

However, the empirical analysis did reveal that expansion of irrigation projects has a strong potential of facilitating household adaptation to increased risks due to climatic change. The results confirm that irrigation weakens the effect of rainfall variability on the incentive to diversify the occupational portfolio of household members. Therefore, as a component of "climate-smart" policy packages in India, irrigation may not only stabilize and increase agricultural yields directly, but also indirectly through the increase in potential output associated with the gains from specialization in agriculture.

Agricultural investment in the Sahel

The second paper titled "Managing Risk with Insurance and Savings: Experimental Evidence for Male and Female Farm Managers in the Sahel" uses a randomized field experiment in Senegal and Burkina Faso to compare male and female farmers who are offered index-based agricultural insurance with those who are offered a variety of savings instruments. By comparing the behavior change that results when offered insurance, the paper is able to offer some insights on the cost of uninsured risk against climatic shocks. This cost remains unobserved when the welfare impact of the disasters is assessed only by considering changes after they occur.

A considerable literature has emerged in recent years that examines the impact of financial instruments that can help households manage agricultural risk. Cole et al. (2013), Karlan et al. (2014), Berhane et al. (2014), Elabad and Carter (2014), and Mobarak and Rosenzweig (2013) assess whether weather index insurance can help households increase investment in agriculture using data from randomized control trials. In Ghana the 25th percentile increases expenditures on agricultural investments by about US$300, from a base of a little more than US$375 (Karlan et al 2014), in Ethiopia insurance resulted in a 13% increase in the likelihood that fertilizer is used (Berhane et al 2014). In Mali the introduction of area-yield insurance for cotton increased the areas planted to cotton by 15% and the spending on inputs by 14% (Elabad and Carter 2014). The paper summarized here contributes to this literature by providing estimates from field experiments in Burkina Faso and Senegal of the impact of weather insurance and three types of savings on a variety of agricultural investments and outcomes.

The experiment was designed to test how demand for and impact of financial products varies with gender. This was done by randomizing the offer of financial instruments to a selected individual within a household. We contend that this is important in the Sahel as---as in much of the developing world—women and men have quite distinct spheres of activity and the risks they face are different as a result. Specifically, women are exposed to much greater physical risk through their child-bearing years than are men and they are more involved in caring for children than are men. As a result, although drought risk affects men and women equally, women appear less immediately concerned than men about drought and more vulnerable to health-related shocks to them and their children. This is perhaps especially the case in parts of rural Sahel where fertility rates are still particularly high.

In 40 experimental sessions conducted in Burkina Faso and Senegal prior to the onset of the planting season, 800 farmers and ROSCA members were endowed with $12 (the cost of half a bag of fertilizer) and randomly offered one of four products, at an exogenously determined

price or interest rate. One instrument was a weather index insurance that was being sold in both countries by local insurance companies sponsored by an international NGO. The other three instruments were savings devices: one was an encouragement to save for agricultural inputs at home through labeling, a second was a savings account for emergencies that was managed by the local group treasurer (either a ROSCA or a farmer's group to which the individual belonged), and a third was a savings account for agricultural input investments that was managed by the same treasurer. The field experiment was conducted in Senegal and Burkina Faso at the same time to allow us to begin to assess the external validity of results within the Sahel.

Although few differences in welfare outcomes were observed one month after the intervention, the insurance product offer resulted in better ability to manage risk among these farmers post-harvest. As a result, insurance was more effective at encouraging agricultural investment than savings. Those in the insurance treatment spent more on inputs and used more fertilizer than those in the savings treatments (Table 1). These findings are quite consistent with those from other studies cited above, although somewhat higher, most likely because these are LATE rather than ITT to estimates.

Table 1: the cost of uninsured risk on foregone investments in agriculture

	Increase as a result of insurance	
	Average	Robust standard error
Spending on inputs (FCFA)	56.0%	(18.8)**
Amount of fertilizer used (fertilizer per acre)	37.5%	(18.8)**
Yields	18.8%	(8)*

Source: Dellavalade et al (2014)

The changes in behavior induced by insurance increased yields suggesting that the year to year cost of uninsured disaster risk on income growth in sub-Saharan Africa is quite substantial. The higher input use that insurance encouraged resulted in yields that were 18.8% higher on average (Table 1) than those without insurance.

The paper also finds much stronger demand for weather insurance among men than among women, and stronger demand for emergency savings among women. This is not driven by access to informal insurance such as transfers, area cropped or types of crops grown. The results thus imply that different patterns of demand for financial products among men and women can result in welfare differences in the long-run. A further exploration of why these differences in demand arise is needed. The paper conjectures that it is as a result of the different nature of risks faced by men and women. If this is the case it would suggest that these differences need to inform how new financial products, such as index insurance products currently becoming more available, are designed to meet the needs of both men and women.

There are limits to the quality of insurance indexed products can provide. The paper is one contribution to the emerging literature on the benefits and concerns of offering indexed agricultural insurance to rainfall dependent smallholder farmers in low income countries. This literature has documented the potential beneficial impact of these products and also concerns. Because these products provide insurance through an index rather than observed losses experienced on a farmer's field, they can have substantial basis risk. Basis risk is the risk that the index differs from the loss. Index insurance typically insures just one source of risk to agricultural

yields—local weather conditions—whereas in the contexts in which it is provided there are often many sources of risk such as pests, floods, and health shocks to agricultural labor. Theoretically it can be shown that basis risk depresses the value and demand for these products (Clarke 2011), and Dercon et al. (2013) and Rosenzweig and Mobarak (2013) provide empirical evidence consistent with the theory. In documenting both the beneficial impact of index insurance and further evidence consistent with the idea that basis risk does limit demand, this paper is one contribution to this broader literature.

Conclusion

Risk-avoidance strategies are commonplace and costly to poor and vulnerable households across the developing world. We argue that neglecting to take this properly into account, and valuing DRFI solely based on the impact of disasters on welfare when they occur, will result in a systematic under-estimation of the value of DRFI strategies for reducing poverty. This brief has presented two empirical case studies, reflective of a broader literature, to reinforce the point that DRFI strategies are important not only for protecting household welfare from covariate and idiosyncratic shocks but also for fostering economic growth, and maintaining social stability.

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