Volatility, Risk and Household Poverty:

Micro-evidence from Randomized Control Trials

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Households in developing countries are often highly exposed to risk. The sources of risk are diverse and can affect almost any household when shocks related to health issues, economic crises, political shocks, or natural disasters. But agricultural households often appear particularly vulnerable, as weather shocks can wipe out a large part of their annual income. It often also affects the income of neighbors and family, making informal insurance arrangements ill-suited to respond to this type of shock. And when agricultural households are specialized in a few crops, they become vulnerable to crop price fluctuations.

While the importance of shocks for agricultural households has long been recognized, there is a growing sense that exposure to risk is further increasing for many rural households in developing countries. Climate change is making weather more unpredictable. Empirical evidence suggests that temperatures are increasing, rainfall is becoming more variable, and extreme events (floods or droughts) are becoming more frequent. Moreover changing weather patterns are disturbing traditional agricultural seasons. As a consequence traditional rules-of-thumb on optimal practices, often passed on from generation to generation, might become useless guidelines for current-day farmers. Increased food price volatility is adding to the amount of uncertainty under which these farmers are making their production decisions.

While households often use a variety of strategies to manage risk ex-ante and cope with shocks ex-post, plenty of empirical evidence has shown that such strategies often remain insufficient to

avoid negative welfare costs. Many questions therefore exist about which type of policies can help households adapt to (increasingly) risky environments. For instance, in the climate change debate, different options of agricultural adaptation, such as irrigation, adoption of drought resistant varieties or changes in cropping practices, are often discussed as policy responses. Yet adaptation through changes in income portfolios or through adoption of new technologies such as index insurance might be equally important to consider.

To complement adaptation strategies, policy makers often resort to social safety nets, and approaches such as food or cash transfer programs or food-for-work programs have become widespread. Many countries in Latin America have adopted conditional cash transfer programs, and the approach has spread to Asia, Africa, and even the US. In India, the national employment guarantee scheme aims at fulfilling the social safety net role. In Africa, various safety net programs are implemented on large scales such as food-for-work, food-for-training, or CCT programs.

Social safety net approaches are often thought of by both governments and donors as potentially powerful instruments to reduce the impacts of negative shocks. Grosh, et al. (2008) discuss for instance how such existing programs may be adapted to help households cope with shocks, such as natural disasters, economic crisis, or food price increases. This could help protect incomes and avoid irreversible losses of physical assets and human capital. It could also help maintain political consensus around the policies needed to resolve the crisis. There is indeed evidence that such programs can help households cope with shocks (see e.g. a recent review by Alderman and Yemtsov, 2012). Fiszbein and Schady (2009) warn however that, at least for the case of CCTs,

such effects likely vary a great deal by country, by nature of the shock and by the outcome that is being considered. Furthermore, most of the available evidence comes from programs that were in place when shocks occurred. As the policy debate in part shifts to the need to design graduation strategies for this type of interventions, a different question is whether such approaches can be modified to help households protect themselves against shocks, even after they exit the program (World Bank, 2012).

This paper contributes to this discussion by focusing on policies specifically designed to help households manage future shocks. Specifically, it draws lessons regarding different policy approaches, starting from recent empirical evidence from randomized control trials. As the existing theoretical literature informed the design of the experiments, the paper first reviews some of the key insights from this extensive literature. It then discusses the findings from a set of RCTs, and discusses to what extent these help to translate the theoretical insights into lessons regarding effective policy design. The experimental evidence often also points to unanticipated outcomes and consequently new research questions. These can further enrich the understanding of households' decision making under risk, and as such inform the policy debate. The paper illustrates this with a couple of examples.

Conceptual base

There is large theoretical and empirical literature on poor households' behavior under risk. This literature has shed light on the many complex and ingenious methods poor households employ to cope with shocks or manage risk (Fafchamps, 2003, Dercon, 2004). Possible strategies households can employ after shocks occur vary from reducing consumption or certain types of

expenditures, de-capitalization of assets, labor adjustments, credit, or by relying on their social capital. In anticipation of future shocks, households might also attempt to manage risk ex-ante by participating in formal or informal insurance arrangements, savings, or income diversification. Ex ante risk-management hence include strategies used by households to reduce the variability of income, while coping strategies attempt to reduce the consequences of the shock ex-post. Various factors may affect households' choice between income and consumption smoothing strategies, including preference parameters (risk aversion), the relative cost of these strategies, as well as credit or insurance market imperfections (Murdoch, 1995). Households with limited ability to smooth consumption ex post are more likely to smooth income (Alderman and Paxson, 1992). The degree to which risk affects production and investment decisions therefore in part depends on potential strategies to cope with shocks.

In the presence of the many market imperfections that poor agricultural households often face, their risk strategies may not be fully effective. Households may then need to decrease consumption in the immediate aftermath of a shock. Depending on the initial level of consumption, and the type of expenditures households need to reduce, shocks can not only lead to short-term welfare losses, but also have persistent or long-term impact on welfare (e.g. Hoddinott and Kinsey, 2001; Dercon, 2004, Carter and Barrett, 2006). Adverse coping mechanisms can have long term welfare effects if consumption smoothing requires decapitalization of productive assets (Fafchamps et al., 1998) or of human capital through reductions in nutrition or health expenditures, or when children need to be withdrawn from school (Alderman, Hoddinott, and Kinsey 2006; Jensen, 2001; de Janvry et al., 2006).

Ex-ante strategies to smooth income can also be very costly. For instance, households may skew their income portfolio towards low-risk low-return activities. Dercon (1996) shows that Tanzanian households with limited liquid assets are more likely to growth low-return, low risk crop such as sweet potato. As a result, households pay an implicit insurance premium of up to 20 percent of their income. Rosenzweig and Binswanger (1993) show that the poorest households in semi-arid India hold a low-risk low-return portfolio and estimate that a one standard deviation decrease in weather risk would raise their average profits by up to 35 per cent. Elbers et al. (2007) show that ex ante risk-management strategies are not only costly, but may even be more costly than consumption smoothing.

Hence despite households' best efforts, high welfare costs of shocks often remain. They might be particularly severe when shocks follow each other with higher frequencies, as households may be unable to recuperate and recapitalize before a new shock hit. In this light, increased variability linked to climate change is of particular concern, and empirical evidence on effective policy strategies can have high value. In the next sections, we review some of the relevant evidence coming from recent RCTs.

Risk management through income diversification

One way to minimize the risk of consumption shocks is by engaging in multiple income-generating activities, so that even if agricultural income fails, there are other ways to get by. Many farmers, however, have little or no source of income outside of their crops and may lack the skills or materials necessary to engage in other income-generating activities, leaving them extremely vulnerable to droughts or severe weather. Is it possible to help households protect

themselves by facilitating income diversification through provision of training or capital ? In Macours, Premand and Vakis (2012) we discuss the result of an RCT designed to answer this question.

The Nicaraguan Government created a one-year pilot program targeting agricultural households affected by a severe drought in 2004. In the short-term, the program sought to help families cope with their immediate problems by giving them cash transfers. In the longer-term, the question was whether external interventions aimed at easing skills or liquidity constraints can help households to diversify their income streams and to better protect themselves against future droughts that could hurt their traditional crops.

The study took place in six municipalities in northwest Nicaragua, where there is a strong dependence on self-employment agriculture, and where recently temperature had increased, rainfall was becoming increasingly irregular and the time window for the two annual crop cycles had shortened. Households were randomly assigned into one of four groups by lottery. The first group qualified for a basic conditional cash transfer (CCT) program, and received bi-monthly transfers conditional on children's primary school and health service attendance. The second group qualified for the same CCT and also received a scholarship for vocational training to develop new marketable skills. The third group qualified for the CCT and also received a lump-sum grant to develop a non-agricultural business. And the fourth group is the control.

Two years after the program ended, families eligible for either the investment grant or vocational training were better protected against droughts than families that qualified only for conditional

cash transfers or were in the control. Families that received either vocational training or investment grants did develop alternate income-generating activities, reducing their dependency on crops. As a result, these households were protected from the effects of severe droughts. When there is a drought (and drought shocks affect more than half of all households in any given year), households in the basic CCT package and those in the control group take a big hit to their income and consumption, but income and consumption of the recipients of the training or grant packages does not vary with the intensity of the exogenous shock.

In addition, households that received grants to start small businesses also had higher average consumption and incomes after the end of the program. And while households that received only the basic CCT had higher consumption during the program, two years after the project had ended, they weren't able to maintain higher consumption in average weather nor when droughts hit, and didn't do better than the control group.

The evidence of this experiment hence showed that the basic cash transfers can help families cope in the short-term, but in this case they did not offer a long-term solution after being removed. In contrast, enhancing the safety net with productive interventions proofed to be an effective strategy to help households successfully develop other income-generating activities to carry them through bad weather and smooth out the "shocks" to consumption that occur when crops fail. Productive safety nets can hence help households protect themselves against shocks and provide opportunities for higher earnings in the longer-term, beyond providing short-term support in times of shocks.

Risk management through formal insurance

Productive safety nets are one possible approach to enhance household risk management. It might however not be the most cost-effective one, nor the obvious one policy makers think of to reduce vulnerability to shocks. When considering instruments or policies to help households manage weather shocks, weather insurance almost automatically comes first to mind. Indeed, in developed countries, government-subsidized weather insurance is a popular policy instrument. In the US alone, federal subsidized crop insurance, covering more than 100 crops provides protection for most farmers. As a consequence, while more than 1000 counties were being declared disaster areas for lack of rain in the summer of 2012, farmers' losses in these areas will be limited through the insurance coverage. Poor rural households in developing countries typically don't have access to such insurance instruments, in part because yield losses of poor small holders are more difficult to observe, leading to adverse selection and moral hazard issues.

Hopes have recently been raised on the potential for index insurance as an alternative policy more suited to the realities of developing countries. With index insurance, insurance pay-outs are based on transparent and objectively measured outcomes. Often these are observed rainfall measures from rainfall stations or satellite information (Barnett, Barret and Skees, 2008). As long as such data allows with sufficient precision to predict the weather shock and related yield losses of individual farmers, they should be interested in buying such insurance and might greatly benefit of that. Based on these insights, a large number of index-based insurance pilots has been put in place in settings ranging from Mongolia, India, Ethiopia, Ghana to Peru (Vargas Hill and Torrero, 2009). A number of those pilots were set up as RCTs leading to an increasingly rich literature with many intriguing insights.

In one of the first studies, farmers in Malawi were randomly offered credit with or without insurance. Surprisingly, take-up was lower for the experimental group with insurance (Gine and Yang, 2009). A possible explanation in this setting was the existence of limited liability in case of default on credit. A number of other studies also demonstrate low take-up of index insurance instruments by farmers, even if these are policies that should increase their expected average returns. E.g. Cole et al (2012) find that in their experimental treatment groups, exposed to different combinations of random encouragements, information and liquidity shocks to increase insurance uptake, only 5-10% purchase insurance. More intriguingly still, most farmers only use a single policy for a fraction of their land. By varying randomly the different treatments they find that take-up in part is a function of trust and liquidity. But to explain the low and discrete take-up decisions, other non-price barriers - that remain somewhat unclear - seem to be important too.

In contrast, when randomly giving free insurance and comparing it with an alternative treatment group that randomly received a cash transfer of the same expected value, two recent studies find benefits of insurance consistent with theoretical expectations. In India (in the same setting as the previously discussed RCT with low take-up) Cole, Gine and Vickery (2012) find that insurance, once it is given for free, significantly affects production decisions, and makes farmers shift to higher return high risk cash crops. Similarly in Ghana, Karlan et al (2012) find that farmers invest more in their farms and make riskier production choices when offered free insurance.

In Ghana, when instead they randomly vary the price, 10 to 20% of farmers buy insurance at market rate, and this share increases as insurance becomes more and more subsidized. A similar

finding is found through random variation in prices in India by Mobarak and Rosenzweig (2012). The later study also investigates whether the presence of informal insurance might help explain low take-up rates.

As can be inferred from the above discussion, the questions analyzed in RCTs on index insurance are often related to the puzzle of low-take up rates, rather than on whether the insurance helps avoid the negative consequences of shocks for households' consumption and human capital. This seems a reflection of the initial empirical puzzles that this research revealed. New RCTs are subsequently designed to answer those new questions.

Role of learning, aspirations, and social marketing – can external interventions change investment behaviors?

When considering many of the puzzles on households responses to interventions aimed at risk management some natural questions to ask are: How are poor agricultural households in fact making decisions about the future? To what extent do they account for the probabilities of different shocks in making such decisions? How might they weight the perceived uncertainties related to the new "technologies" the outside interventions may be offering, whether this is income diversification, weather insurance or another adaptation strategy. Given low levels of education and numeracy, and possibly of cognition more generally, the answer to those questions seems far from obvious. And where climatic changes are affecting the timing, the level, and the variability of rainfall or temperature, farmers decision making becomes even more difficult as past weather trends are not necessarily a good predictor of the probability of extreme events in the future.

Experiments focused on increasing trust and learning help shed some light on these decision making processes. A laboratory experiments conducted in the Ethiopia by Vargas Hill and Visceisza (2012) suggest that, over time, subjects learn the benefits of insurance and capitalize on it. And by analyzing multi-year experiments, Cai, de Janvry and Sadoulet (2011) and Karlan et al (2012) show that demand for index insurance is very sensitive to the experience of the farmer and others in his social network with the insurance product.

More generally, digging deeper into the way poor rural households may think about the future can help to understand their inter-temporal decision-making and as such inform policy design. This is particularly the case as outside interventions might be able to change households' aspirations, by providing new opportunities and examples of local success-stories that might otherwise have seemed infeasible. In Macours and Vakis (2009) we show, in the setting of the previously discussed experiment, that random exposure to successful leaders substantially altered the way households were thinking about the future, making them more optimistic and less depressed. Consistent with this change in aspirations, we find very large multiplier effects on productive investments of proximity to leaders who randomly received the productive investment grant. Intriguingly, we also find such spill-overs for human capital investments. In qualitative work, beneficiaries argued that prior to the intervention, they would not necessarily think about the future, but rather live from day to day. Other experimental evidence is starting to emerge that similarly suggests the potential for outside interventions to change people's attitudes towards the future. In Mozambique, Laajaj (2012) finds that randomly selected recipients of either an agro-input subsidy or a matched savings intervention, reacted to the intervention by increasing their planning horizon.

To further advance the understanding regarding the potential of outside interventions to change inter-temporal decision making by changing perceptions about the future or about future returns, it might be worth considering some of the lessons learned from the literature on households' investments in human capital. Particularly relevant for instance might be the evidence on changes in investment behavior when providing information on returns to schooling (Jensen, 2010), better nutrition (Fitzsimons, et al, 2012) and health (Dupas, 2011). The evidence suggests that external interventions can substantially alter parental practices, even in areas such as early childhood parenting where long-held customs and traditions might be pre-dominant (e.g. Grantham-McGregor, 1991). And evidence on the potential to sustain such changes in behavior is also starting to emerge. E.g. in the context of the previously discussed experiment in Nicaragua, Macours, Schady and Vakis (2012) show that shifts towards investments beneficial for early childhood development were sustained two years after the end of the program.

In all these interventions, information regarding the risks involved with current practices, and information on returns to changes in behavior play a key role. This raises a question regarding the potential returns to providing such information regarding productive investments. Analyzing to what extent providing weather forecasts or information about changes in weather patterns affects production decisions might be an interesting avenue for further research.

Conclusion

Given the high welfare costs of poor rural households exposure to risk, and given the possibility that risks due to weather and other factors might be further increasing, renewed attention on

improving households risk management strategies is warranted. An overview of some of the insights learned from recent RCTs indicates their potential to shed light on some of the predictions coming out of the large existing theoretical literature. It also reveals new puzzles and questions regarding households' inter-temporal decision making under risk.

These questions can inspire further academic research but also imply important policy lessons. For instance, the low and price-elastic demand for rainfall insurance raises doubts about the potential for this type of insurance as a general solution for all poor agricultural households to manage their risks. One conclusion then is to consider it rather as an instrument that could complement both traditional safety nets, and policies that integrate productive interventions into safety nets approaches. The emerging evidence suggests such productive safety nets can be effective to promote sustainability of program impacts, and help households manage risk before future shocks occur.

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