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Can Financial Innovation to Mitigate Risk Lead to Greater Investment and Higher Welfare? A Field Experimental Approach

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The Green Revolution introduced high-yield crop varieties, chemical fertilizer and other modern cultivation practices that led to a tremendous increase in global agricultural productivity. Yet, the impact of these new technologies on farming practices and output has been uneven. In many areas, traditional farming practices still predominate, and take-up of new agricultural technologies and practices remains limited, despite their high expected rates of return (see Duflo, Kremer and Robinson, 2008 and Suri, 2009). Credit constraints and limited access to information are often proposed as explanations for low investment and technology adoption in the developing world (Feder, Just and Zilberman, 1985).

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• • • / • • • An additional explanation, however, which has also drawn significant attention, is that low agricultural investment is a response to the riskiness of these investments (Lipton, 1989). Although key farm inputs increase average agricultural profitability, there is significant variation in their return on investment. For example, the returns to fertilizer in semi-arid areas are positive only if there is sufficient rainfall, an event that is beyond the household's control. Consequently, risk-averse households may be unwilling to bear income fluctuations associated with these investments and may decide not to adopt them, or instead to shift towards lower-risk, lower-return strategies (Eswaran and Kotwal, 1990). Morduch (1995) refers to these as "income-smoothing" activities, and estimates that income-smoothing behavior may significantly reduce household incomes in developing countries.

Fundamentally, income smoothing behavior arises from the inability of households to insure themselves against shocks, such as fluctuations in monsoon rainfall. With complete and frictionless financial markets, households would be able to protect consumption from the effects of these shocks, and thus invest in activities with the highest expected return. But in developing countries, insurance markets are typically incomplete or altogether absent. Thus lack of insurance leads to underinvestment in key inputs such as fertilizer (Dercon and Christiaensen, 2007).

In addition, despite the surprisingly high degree of consumption smoothing through both ex-ante and ex-post risk coping strategies to overcome idiosyncratic shocks (Udry, 1994; Townsend, 1994), households seem to be less able to insure themselves against aggregate shocks. These are shocks that affect everyone in the local environment and are therefore harder to diversify locally. In these instances, the ex-post consumption smoothing possibilities become more limited.

An implication of this literature is that a reduction in production risk would increase investment. Our earlier experimental work (Giné and Yang, 2009 and Cole et al. 2009) offered insurance randomly to test this hypothesis. However, uptake has been too limited to allow an assessment of its impact.

The Experiment

This paper builds on this earlier experimental work conducted since 2004 in Andhra Pradesh, India and reports on a randomized evaluation of the effect of providing a substantial amount of rainfall insurance coverage to rainfed farmers on their crop choice and input intensity decisions. Study households received a door-to-door visit in June 2009 prior to the beginning of the monsoon season. During the visit, an enumerator first conducted a small survey about farming practices, and then explained the recommended fertilizer dosages for castor and groundnut, the two main (rainfed) cash crops in the area. The enumerator then explained the concept of insurance to the household, and gave specific details about the policies. Then households were given a scratch card which offered a (randomly determined) discount on fertilizer, as well as one of two financial products: rainfall insurance sufficient to cover the planting costs of one hectare (10 policies); or the promise of a cash payment equivalent to the expected payouts of these 10 policies, to be paid at harvest time. These fertilizer coupons and cash / insurance treatments were applied randomly and independently across households.

The insurance policy provided cash payouts based on measured cumulative rainfall during the planting phase of the monsoon season. A significant theoretical advantage of the insurance design is that, since payouts are based on measured rainfall, they can be calculated and disbursed quickly and automatically without the need for households to formally file a claim.

Voluntary crop insurance at subsidized rates is available from the government insurance company, yet few farmers purchase it. Unlike rainfall insurance, the crop insurance scheme is not commercially viable. Moreover, the government-owned insurance company often pays claims late, as late as two years after the harvest time has passed. In contrast to crop insurance, rainfall insurance involves substantially lower transaction costs, avoids frictions caused by asymmetric information and moral hazard, and requires no claims verification.

The downside is that by design, rainfall insurance only covers deficit rainfall, thus leaving the farmer exposed to other risks such as pest infestation, etc. However, in a survey conducted both in 2004 and 2006, 90% of the sample ranked weather risk as the single most important risk they face. Also, the rainfall recorded at the rainfall gauge could differ substantially from the rainfall at the farmer's plots, but because policies are sold within a 15 mile radius from the weather station, and the topography in the study area is flat, this is not a source of concern.

Results

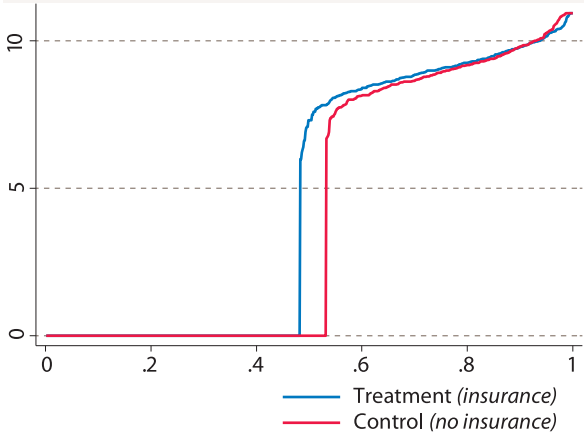
We find no change in overall land cultivated or overall intensity in input usage but for a sizeable number of farmers, Figure 1 shows that the insurance treatment pushes them from not growing cash crops into growing them. Treatment effects are therefore quite non-linear. For those farmers at the top of the distribution—who are generally the wealthiest—insurance does not have any effect on investment as they are already investing a large amount in cash crops.
These results are important because they demonstrate that when a population has substantial levels of risk coverage, they will adjust their investment decisions towards more profitable, albeit riskier, crops.

Policy Recommendations

While these results do not represent a "magic bullet" vindicating rainfall insurance, they do provide evidence that farmers can change farming practices remarkably quickly when offered a product that manages financial risk. Precise welfare calculations are difficult when only one outcome is realized. Nevertheless, the results suggest that allocative efficiency and farmer income could be significantly improved by the introduction of innovative financial instruments.

Just as importantly, these results will help us quantify the real cost of ex-ante rainfall risk to farmers. These costs can, for example, be combined with climate change models to better understand the costs that increased weather variability will impose on small-scale farmers.

Cumulative distribution of natural of log investment in cash crops



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