How Does Risk Management Influence Production Decisions? Evidence from a Field Experiment

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Underinsurance and Underinvestment

- Estimates of marginal rates of return on investment in developing countries are generally very high (Duflo, Kremer and Robinson, 2008; Suri, 2010; McKenzie et al. 2009).

- **One possible explanation**: high expected returns are compensation for uninsured production risk.


- In the finance literature, firms reduce investment in low returns activities when firms expect to be financially constrained (Froot and Stein, 1998).
The Experiment

- **Sample**: ca. 1,500 households from 2 districts of drought-prone areas of Andhra Pradesh. Two-thirds are part of earlier 2004 & 2006 surveys. Remainder from study villages + nearby villages.

- **Randomization design**:
  - Half of the farmers (chosen randomly) were given 10 Phase-I weather insurance policies that would cover all inputs cost (seed, FYM, fertilizer and labor) for a hectare of main cash crop in the district.
Insurance Design (Example contract)

Retail-level “rainfall derivative”

Underwritten by a large insurer (ICICI Lombard) and marketed by local MFIs

Insurance splits monsoon into three phases:
(i) Sowing (Phase I)
(ii) Podding / flowering
(iii) Harvest

Payouts in each phase based on cumulative rainfall in the phase (each is 35-45 days)
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  - Other half of farmers receive coupon for approximate expected value of the policy (Rs 350) to be redeemable after harvest, when payouts (if any) are due. We do this to control for any wealth effect.
  - Farmers also received up to three vouchers for fertilizer bags, with randomized discounts. (Not discussed in detail here).
The Experiment
Timeline

May 2009

Household visit:
- Short baseline survey
- Scratch-card

Planting and Investment Decision

August 2009

Follow-up Survey I begins

April 2010

Harvest time

Follow-up Survey II (study ex-post risk sharing)
Hypotheses

- Farmers underinvest in inputs due to rainfall risk
  - Randomly assign insurance at the start of the monsoon
    - Effects on total investment?
    - Substitution between cash crops and subsistence crops?
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- Two approaches to testing these hypotheses
  - Qualitative Evaluation
    - Ask farmers before planting, if they adopt costly risk-coping strategies
    - Ask insured farmers after planting, if they changed behavior
  - Experimental evaluation
Basic results: Difference in investment rates

- $\ln(\text{total value of ag. inputs, Rs.})$
- $\ln(\text{land under cultivation, in acres})$
- $\ln(\text{market value of fertilizer used})$

All Crops

Cash Crops
Input usage in individual categories

Graph presents point estimates in fraction of farmers reporting positive usage of the input listed in the production of cash crops.
Cumulative distribution of cash crop investment

- Figure: cumulative distribution of log investment in cash crops by treatment status [insurance vs no-insurance].
- Treatment effect is non-linear. Primary effect is on extensive margin.
Timing

**Figure:** Fraction of farmers who had planted cash crops by different points during 2009 monsoon season: difference between treatment and control group.

**Figure note:** Left and middle vertical lines show period during which field experiment was implemented. Right vertical line shows Kartis in which period of insurance coverage ended.
Ex-ante or Ex-post behavior?

Farmer investment is continuous: Farmers wait for first rains to plant.

Insurance reduces risk but also increases wealth as season evolves.

So increased investment in cash crops may represent pure risk mitigation and higher ability to re-invest if crops fail.

Mahbubnagar: Early on, farmers could have known significant payout was very unlikely.

Hindupur: Probability of large payout increasing over time.
Interaction effects

- Production response may depend on wealth, or experience with insurance product and perceptions about production risk.

- Among treated farmers:
  - Those that perceived cash crops as riskier were more likely to change behavior as a result of insurance.
  - But richer farmers were also more likely to change behavior.
  - The actual payout to be received did not influence change in behavior, pointing to ex-ante changes, rather than ex-post.
Summary of findings

- Evidence that access to hedging instruments influences real investment for our sample of small farmers / firms.

- Main margin: substitution from less risky to more risky investments (subsistence crops to cash crops).

- Effect size concentrated in the median, but it appears large: increase of Rs. 1500 investment in cash crops when provided with Rs. 350 in insurance.
In 2009, India experienced its worst monsoon since 1972. From June to mid-August, when planting takes place, rains in our survey areas were 29%+ below average.

Significant payouts on the insurance policies distributed by us as part of these experiments.

- Maximum payouts: Rs 10,000 (US 210), paid to about 250 farmers.
- This amount of funds is significant. Equals twice the average amount of savings (and four times the median level of savings), or roughly one fourth household revenue.

Questions: (i) How did households smooth this shock? (ii) funds used for later investments after received? (iii) Test consumption smoothing.

- Using second follow-up survey for analysis.