Risk in Agriculture and the Tools of Protection

Craig McIntosh, UCSD

World Bank-CEGA Workshop
June 28, 2016
The most numerous small businesses in the developing world:

**Family Farms!**

Risk matters

- Most investments in improved inputs increase the financial risks of farming.
- Weather risk not addressable by informal risk pooling arrangements (Townsend 1994).

Four solutions to risk:

1. Financial instruments: Weather Index Insurance (WII)
2. Technology that structurally decreases risks
   - Risk-mitigating crops, irrigation
3. Credit products with (explicit or implicit) limited liability in case of weather shocks.
4. Public sector safety nets
Insured farmers changed production

- When given subsidized insurance, farmers took on greater production risks
  - In Andhra Pradesh, farmers who received insurance were 6pp more likely to plant cash crops (Cole et al. 2014)
  - In Ghana, farmers increased the share of land planted to maize, fertilizer use (Karlan et al. 2013)
  - In China, insurance for sows causes farmers to move into this risky but highly profitable crop (Cai et al. 2014)
  - In China, farmers given tobacco insurance increase production of this risky crop by 20% (Cai 2012)
However, demand for WII is Low

- Take-up 6-18% at market prices
  - Those who purchase insure small portion of land
- But (very) large subsidies increased demand
  - India: over 60% of farmers purchased insurance with 75% discount
- Few examples of commercial weather index insurance products
  - Most insurers receive large subsidies or technical assistance
  - Subsidized, compulsory Weather Based Crop Insurance Scheme in India
- Contrast to microfinance!

Gaurav et al 2011; Karlan et al 2013; Mobarak & Rosenzweig 2012
Demand increases w/ subsidies

Demand for index insurance was low at market prices but increased with large discounts.
Cash vs. Free Insurance:

- Once we start to think of subsidies as a permanent necessity in WII markets,
  - Is it better to simply provide Unconditional Cash Transfers than it is to distribute the same resources in the form of free/subsidized premiums for WII?
- Fortunately, this experiment has been performed by Karlan et al. (2013) in Ghana.
The DIRTS Study:

Karlan et al 2013
Suggests that Credit not binding constraint

• If both were given away free, study offers cash amounts that are an order of magnitude larger than WII premium subsidies, but behavior change from WII subsidies are an order of magnitude larger.
• When households are released from risk constraints they can find the capital to substantially increase investment.
• Hence, credit not binding!

Karlan et al 2013
Cash vs. Premiums:

- Current debate in social protection about UCTs versus various types of conditional cash transfers.
- Distributing free insurance premiums can be thought of as providing a very specific type of CCT: ‘If your crops fail, we will provide you with a cash transfer’
- The underlying logic for this is that the release of risk constraints allow farmers to move toward pure profit maximization as farming decision-makers.

- Links WII to social protection.
Downside of subsidizing risk

- Substantial shift into risky production in several studies when individuals are provided with subsidized WII.
- This means that the agricultural system as a whole has greater sensitivity to rainfall.
- Landless laborers, who are the most vulnerable, see higher wage sensitivity to rainfall when farmers are using WII.

Mobarak & Rosenzweig 2014
Wages more sensitive to rainfall in presence of WII.

This means that agricultural laborers become more vulnerable if only agricultural producers adopt WII and therefore deepen their structural exposure to weather.
2. Risk-reducing Technology

• On the face of it, financial instruments to reduce risk and crop technology to reduce risk appear to be similar (at least for the producer).

• However, the preceding argument suggests this may not be the case:
  • If the use of financial instruments results in an undesired increased exposure to risk, can this be avoided by using risk-protecting seed technology?
An alternative: Risk-mitigating crops

- Agricultural R&D on varieties that tolerate flood, drought, salinity
  - Increasingly important with climate change
- Swarna-Sub1 is a flood-tolerant rice variety
  - No yield penalty in normal conditions
  - Researchers tested effect in real-life conditions in Odisha, India

Dar et al 2015
Farmers given Swarna-Sub1 invested more

• Farmers given Swarna-Sub1 had higher yields in 2011 floods

• Farmers invested more in their farms
  • Cultivated more land
  • Applied more fertilizer
  • Switched to more effective, but higher-labor techniques

• Scale-up would benefit marginalized populations the most, as they are more likely to hold flood-prone land
  • IRRI has already distributed stress-tolerant seeds to over 10 million farmers in India

Dar et al 2015
3. Interlinking WII with Credit

• If the problem with agricultural underinvestment lies at the nexus of input capital and risk, why not address both constraints simultaneously?

• Attractive in theory:
  • Demand side: can alleviate ‘risk rationing’ and bring individuals into the credit market who had productive investments but were not willing to borrow.
  • Supply side: can crowd in credit supply if portfolio exposure to weather risk was keeping lenders out of agriculture.

• Problematic practice:
  • ‘culture of repayment’; very hard to maintain repayment rates once conditionality of repayment has been introduced.
Is interlinking with credit a solution?

- India has massive National Agricultural Insurance Scheme, covers 13.6 million farmers but:
  - System is mandatory, heavily subsidized, requires 100% of the agricultural lending portfolio be covered by insurance.
  - Should borrowers be aware of the presence of interlinking?
    - More attractive product for banks if not (collect loans + insurance) therefore cheaper, but won’t address risk rationing if the farmers don’t know about it.

- In practice, no evidence that interlinking works well.
  - Giné and Yang (2009) show in Malawi that demand for loans that bundle insurance with credit is lower than demand for standalone credit!
  - Banerjee, Duflo, and Hornbeck, 2014 similarly see microcredit demand fall when interlinked with insurance (not WII).
  - McIntosh et al. experiment with Interlinking in Ethiopia, find that the credit contracts are difficult to establish, demand for both standalone and interlinked loans is low.
4. Public Safety Nets and WII

- Public-private partnerships for Risk Layering (Carter 2011)
- When not explicitly combined, public-sector programs such as Ethiopia’s PSNP crowd out demand for WII (Duru 2015).
  - However, if private sector WII isn’t viable, this is not a major downside.
- Safety net programs also expose governments to potentially huge weather-related risk.
  - Governments should use reinsurance themselves?
  - Transfer huge and unexpected liabilities into a predictable flow of costs for public sector.
  - Mexico’s CADENA program.
- WII appears to be a way of providing safety nets without problems of clientelistic demands & soft budget constraints, but may be hard to achieve this in practice.
Conclusions on WII:

• No evidence that the products tested to date can scale to be commercially viable, private sector solutions to agricultural risk.

• However, still clear that risk is a major constraint for smallholder farmers
  • Especially weather risk

• Low demand for weather index insurance as commercial product
  • Price, distrust, lack of financial literacy, basis risk

• So where do we go from here?
(1) Embrace subsidized WII:

- The risk-reducing properties of WII can create multiplier effects in production.
- Free WII can combine the goals of a social safety net program with productivity enhancement.
- WII may be an important part of reducing vulnerability to climate change
  - But important to note that reinsurance premiums climb as the degree of uncertainty surrounding the distribution of future weather increases.
(2) Risk-Protecting Ag Technology

- Invest in producing, distributing improved seed technology.
  - CG centers
  - Promising results on NERICA rice in Sierra Leone
    - Faster-maturing varieties provide food during the hungry season, when given in combination with extension show decreases in malnutrition? (Glennerster & Suri, ongoing).

- Irrigation.

- These technologies insulate the whole ag system against risk and hence protect laborers as well as farm owners.
- Appear to be progressive in the incidence of their benefits through exposure to risk as well (Dar et al. 2015).
(3) Can WII be rescued w/ better design?

• Improvement of the design of WII products:
  • Basis risk does decrease demand: In Uttar Pradesh (7), for every kilometer increase in perceived distance from the weather station, demand declined by 6.4 percent (similar to offering a 10 percent discount from market price).
  • Tension between simplicity of index design (good to make them credible and comprehensible) and decreasing basis risk (requires complex indexes).

• So, build better indexes:
  • New possibilities to predict yields at the plot level using remote sensing?

• Providing index insurance to groups that are already engaged in risk smoothing?
  • Dercon et al. Ethiopia, McIntosh et al. Guatemala, Mobarak & Rosenzweig India.
(4) Pursuing Meso-level insurance:

• **Banks can use index insurance:**
  - Think of WII reinsurance as a hedge against the portfolio risk to ag lending coming from weather.
  - Need to allow banks to choose the extent of reinsurance; Indian requirement to purchase 100% coverage proves too expensive.
  - Possible that subsidizing WII for this purpose proves a (relatively) inexpensive way to crowd credit into agriculture?

• **Governments can use index insurance:**
  - Turn the huge and unpredictable flows of disaster relief into a predictable flow of payments.
  - Avoid the political agency problems that come along with disaster-driven bailouts; index as discipline device.
  - Need to think very carefully about political economy of purchase, payout decisions.