Index-Based Livestock Insurance (IBLI): On the Positive Impacts of An Imperfect Product

Christopher B. Barrett, Cornell University

International Programs- CALS Seminar
Cornell University
March 7, 2018
Motivation: Poverty Traps And Catastrophic Risk

There is strong evidence of poverty traps in the arid and semi-arid lands (ASAL) of northern Kenya and southern Ethiopia. These put a premium on risk mgmt.

Catastrophic herd loss risk due to major droughts identified as the major cause of these dynamics.

Motivation: Increased Risk From Climate Change

Pastoralist systems adapted to climate regime. But resilient to a shift in climate? Many models predict increased rainfall variability (i.e., increased risk of drought).

Herd dynamics differ b/n good and poor rainfall states, and so change with drought (<250 mm/year) risk.

In southern Ethiopia, in expectation, doubling drought risk leads to system collapse in the absence of any change to prevailing herd dynamics.

Source: Barrett and Santos (*EcolEcon* 2014)
Motivation: Standard Responses to Drought

Standard responses to major drought shocks:
1) Post-drought restocking (futile at low levels, Santos & Barrett 2018)
2) Food aid (slow, expensive, can reinforce sedentarization, Nikulov et al. PLoS ONE 2016)

Core issue, “the social protection paradox”: If transfers go only to those already in a poverty trap, the poor population grows as shocks knock non-poor into the poverty trap. Over time, social protection resources get exhausted. (Ikegami et al. 2018)
Alternative Responses: Insurance?

Commercially sustainable insurance can perhaps:

- Prevent downward slide of vulnerable populations
- Crowd-in investment and accumulation by the poor
- Induce financial deepening by crowding-in credit
- Let us focus humanitarian resources on the needy

But can insurance be sustainably offered in the ASAL?

Conventional (individual) insurance unavailable b/c:

- Very high transactions costs, esp. w/little financial intermediation among pastoralists
- Moral hazard/adverse selection
Index insurance is a variation on traditional insurance:

- Do *not* insure individual losses.

- Instead insure some “index” measure that is strongly correlated with individual losses.
  (Examples: rainfall, remotely sensed vegetation index, area average yield, area average herd mortality loss).

- Index needs to be:
  - objectively verifiable
  - available at low cost in real time
  - not manipulable by either party to the contract
The Potential of Index Insurance

Index insurance can obviate the problems that make individual insurance unprofitable for small, remote clients:

- No transactions costs of measuring individual losses
- Preserves effort incentives (no moral hazard) as no single individual can influence index
- Adverse selection reduced as payouts do not depend on the riskiness of those who buy the insurance

Index insurance can, in principle, be used to create a timely, financially sustainable, self-targeting safety net to protect pastoralists against catastrophic drought shocks.

Could also accelerate herd recovery, altering herd dynamics and averting system collapse if drought frequency increases. Perhaps crowd in value-adding investments, too!
The Major Challenges of Index Insurance

1. **High quality data** (reliable, timely, non-manipulable, long-term) to design/price product and to determine payouts

2. **Minimize uncovered basis risk** through product design. Is it insurance or a lottery ticket? All turns on basis risk!!!

3. **Innovation incentives** for insurers/reinsurers to design and market a new product and global market to support it

4. **Establish informed effective demand**, especially among a clientele with little experience with any insurance, much less a complex index-based insurance product

5. **Low cost delivery mechanism** for making insurance available for numerous small and medium scale producers
Index-Based Livestock Insurance: Design

**The signal:** Normalized Difference Vegetation Index (NDVI) collected by satellite

**Original response function:** regress historic livestock mortality onto transforms of historic cumulative standardized NDVI (Czndvi) data. Now, just NDVI.

**Indemnity payments:** In Kenya, predicted livestock mortality >15% according to:

\[
\text{max} \left[ \text{index}_{d,t} (L_{d,t}, \mu_{d,t}) - 0.15, 0 \right] \times \text{value of livestock insured}
\]

**Temporal Structure of IBLI contract:**
12 month contract sold during 2-month sales windows just prior to usual start of seasonal rains. Payouts March 1 and/or October 1.

Chantarat et al. *JRI* 2013
**Index-Based Livestock Insurance: Implementation**

**Commercial underwriters:** In Kenya: UAP, APA, Takaful. In Ethiopia: OIC

**International reinsurers:** Swiss Re, Africa Re

*Lots* of implementation challenges.

IBLI team developed extension/financial education programs to (randomly) inform prospective buyers.

Payouts have occurred as designed! 😊
IBLI Pilots in Ethiopia and Kenya


Kenya sampling overlaid with HSNP coverage and randomized premium discount coupon distributions as research design.
Covariate risk is important but household losses vary a lot ...

... even for a given household over time.

Notes: The left figure illustrates the covariate (average) loss rate in each season. The right figure illustrates the distribution of losses within each seasons. The boxes depict the interquartile range, the upper and lower adjacent values are either 3/2 the interquartile range or the value furthest from the median. The remaining observations fall outside the adjacent values.

Notes: Household-season herd loss rate spreads (mean in red, ±1 SD in blue), ordered by hh avg loss rate (top), and distribution of hh avg loss rates (bottom).
And the index does not perfectly track covariate losses.

Notes: Covariate loss-index observations are seasonal division average mortality paired with the index value for that division-season. Fitted lines and confidence intervals are generated by regressing livestock mortality rates on the index.

- IBLI hhs still hold most risk: 62-77% of total risk exposure remains
- Most basis risk is idiosyncratic and random, not targetable or correctable.
- Significant design risk (unintended systematic underpayment)
- Significant spatial variation in covariate share – geographically target IBLI?
IBLI: A Highly Imperfect Product

Because of basis risk, esp. false negatives, IBLI cannot stochastically dominate no insurance. Are buyers better off?

Survival rate w/o insurance (L) and net of prem/indemnity payments w/IBLI (R).

Note:  - small probability of negative survival rates!
       - increased dispersion of outcomes due to false payments>losses

Jensen, Barrett & Mude AIAE 2016
IBLI Uptake Significant … But So Is Disadoption

In HH surveys, in Borana (Ethiopia)/Marsabit (Kenya):
- 54/44% ever purchased IBLI within first 4 sales periods
- But repurchase rates low: 18-68%/16-27%
- High rates of disadoption: 26/41% within 2 years
Key determinants of IBLI uptake

General uptake findings — robust across specifications and surveys

**Price:** Price inelastic response to premium rate.

**Design Risk:** Design error reduces uptake; greater effect at higher premium rates.

**Idiosyncratic Risk:** Hh understanding of IBLI increases effect of idiosyncratic risk.

**Understanding:** Extension/marketing improves accuracy of IBLI knowledge but no independent effect of improved understanding on uptake.

**Herd size:** Likelihood of uptake increasing in HH herd size.

**Liquidity:** IBLI purchase increasing w/HSNP participation and HH savings.

**Intertemporal Adverse Selection:** HHs buy less when expecting good conditions.

**Spatial Adverse Selection:** HHs in divisions with covariate risk are more likely to purchase and with greater coverage (spatial adverse selection).

**Gender:** no gender diff in uptake. Women more sensitive to risk of new product.

IBLI’s Impacts

**IBLI coverage:**
- Increases animal health expenditures, milk income/TLU, total hh income, child MUAC, and non-distress livestock sales
- Reduced distress livestock sales, herd losses, and meal skipping during drought
- Reduced non-drought herd size in Kenya (reduced precautionary savings?), increased non-drought herd size in Ethiopia (better ROI?)
- Initially reduces herding effort, which then recovers as herders learn IBLI
- Increases subjective well-being by far more than buyer’s remorse effects of lapsed insurance that doesn’t pay out.
- Crowds in informal transfers within communities, addressing basis risk
- Marginal impact on income or MUAC is 6-45x that of HSNP cash transfers!

Janzen & Carter NBER 2013; Jensen, Barrett & Mude *JDE* 2017; Tafere et al. *WB* 2017; Takahashi, Barrett & Ikegami in review; Toth et al. 2018
Next steps w/IBLI?

Sharia-compliant version already successfully launched (Takaful)

Kenya gov’t took nationwide through Kenya Livestock Insurance Program

Now reviewing new, appropriate sites where partners have requested help:
- Significant livestock herds
- face high covariate herd loss risk related to drought
- adequate insurance infrastructure

Best bets for next expansions: Niger, Mali, Burkina Faso, South Africa

(higher risk sites: Chad, Somalia, South Sudan, Sudan)

(Mills et al. 2016)
Although IBLI offers incomplete and imperfect coverage against herd loss, uptake is solid and IBLI has clear favorable impacts on purchasers.

IBLI offers a promising option for addressing poverty traps that arise from catastrophic drought risk ... and impacts/$ > cash transfers

Thank you for your time, interest and comments!

For more information visit www.ilri.org/ibli/