Cornell University

The Favorable Impact of Index-Based Livestock Insurance (IBLI): Results among Ethiopian and Kenyan Pastoralists

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Workshop on Innovations in Index Insurance to Promote Agricultural and Livestock Development in Ethiopia

Addis Ababa, Ethiopia, December 3, 2015

Motivation: Target Population and Events

Motivation: Standard Responses to Drought

Standard responses to major drought shocks:

1) Post-drought restocking **2) Food aid**

Key Problems:

- **Slow; Expensive; Reinforce sedentarization**

The Potential of Index Insurance

Index insurance is a variation on traditional insurance:

- Payments triggered immediately by an event
- 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 does not matter as payouts do not depend on the riskiness of those who buy the insurance

Index insurance can perhaps create a timely, commercially-provided, 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.

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? The answer 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

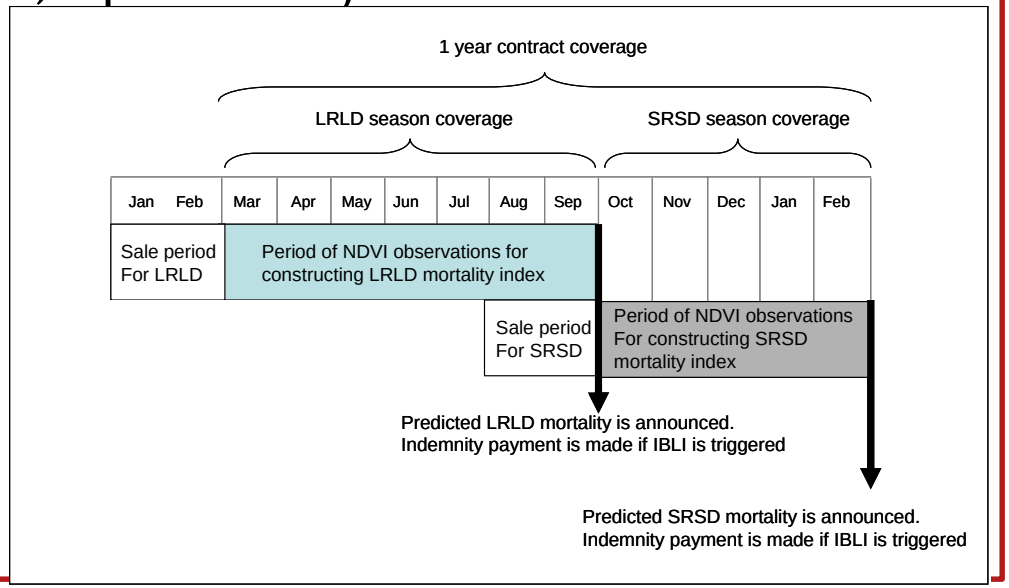
Response function: In northern Kenya, regress historic livestock mortality onto transforms of historic cumulative standardized NDVI (*Czndvi*) data. In Borana, just NDVI. Designed to minimize household-level basis risk.

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

$$max\left[index_{d,t}(\bar{L}_{d,t}, \mu_{d,t}) - 0.15, 0\right] * value\ of\ livestock\ insured$$

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

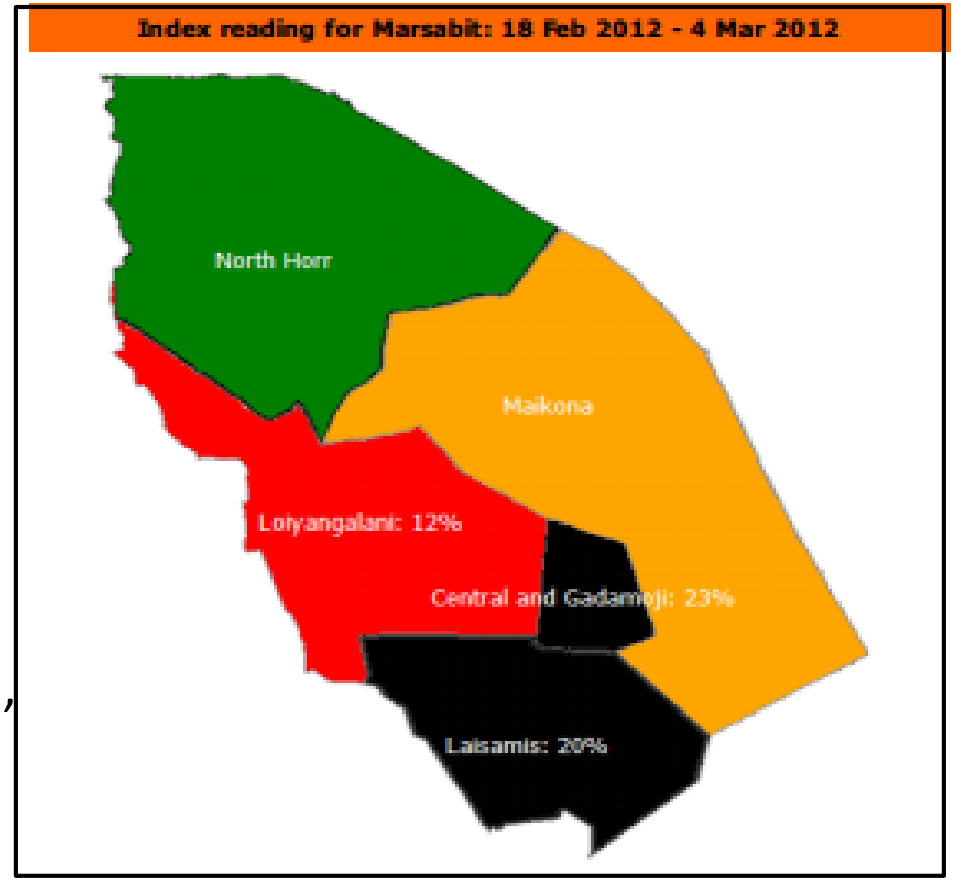
International reinsurers: Swiss Re, Africa Re

Lots of implementation challenges

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

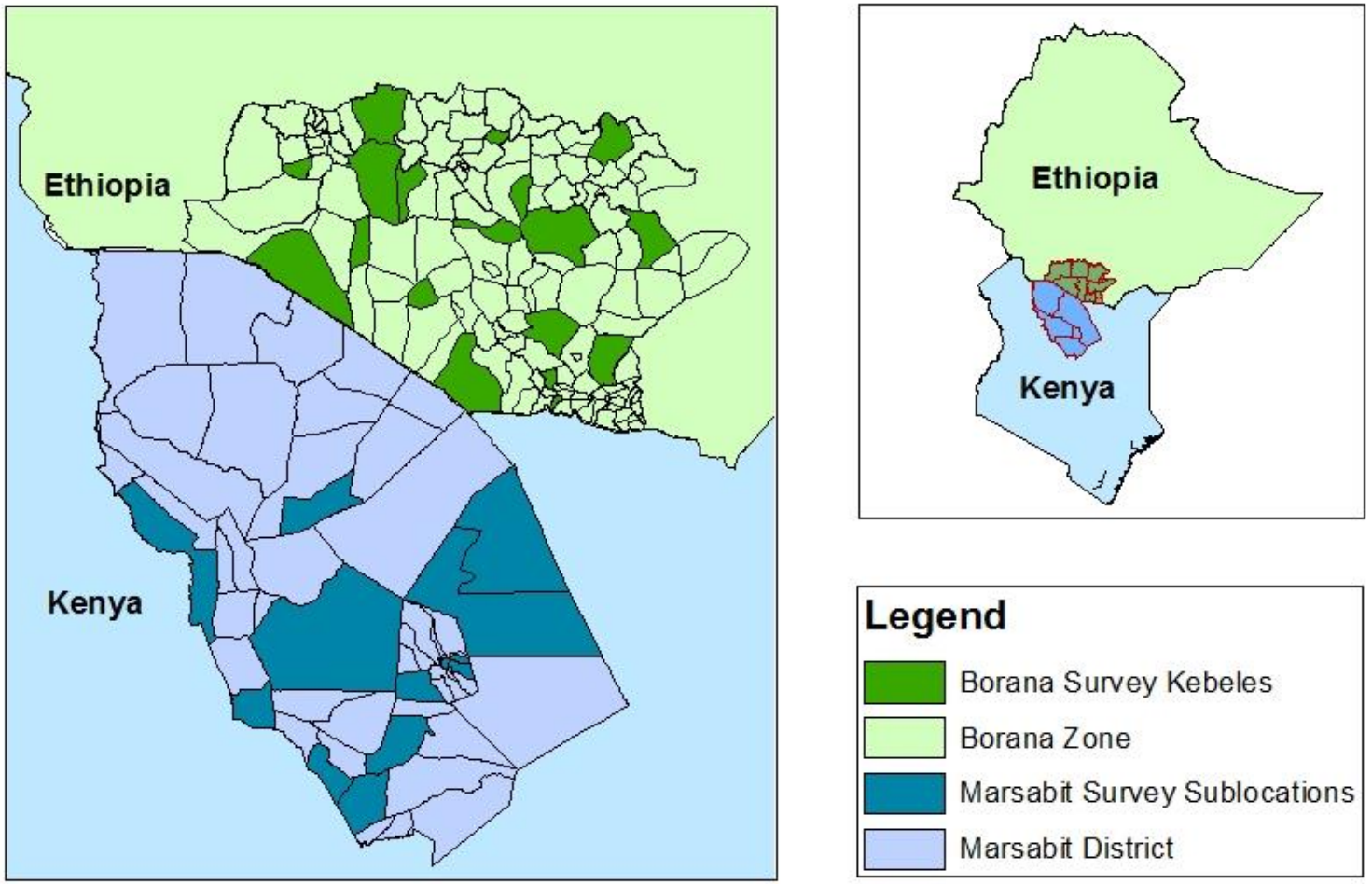
IBLI team (randomly) distributed discount coupons to induce uptake and to establish price elasticity of demand.

Payouts in Kenya in Oct 2011, Mar 2012, March 2014
Payouts in Ethiopia in Nov 2014



IBLI Pilots in Ethiopia and Kenya

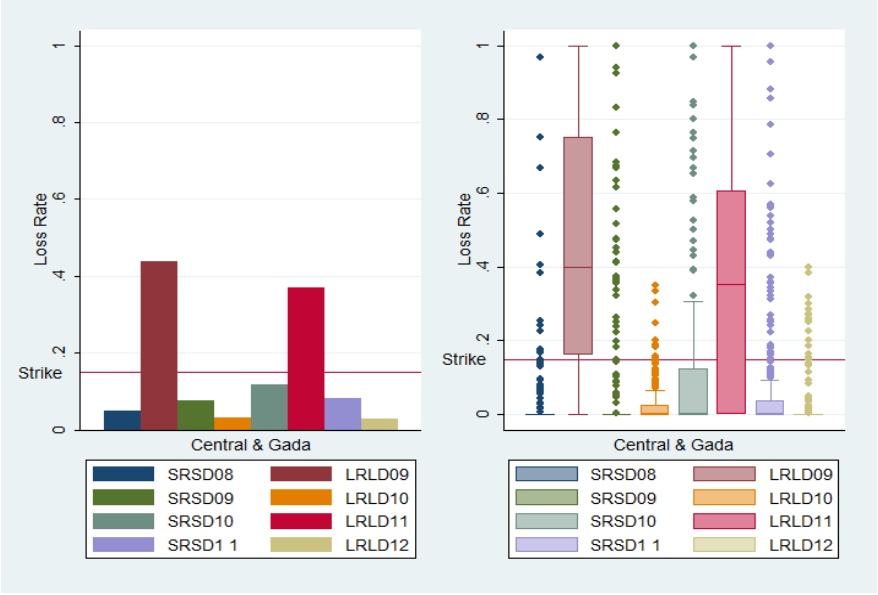
IBLI products (surveys) launched in Marsabit, Kenya in Jan 2010 (Oct 2009) and in Borana, Ethiopia, in Aug 2012 (Mar 2012).



Kenya sampling overlaid with HSNP coverage as research design.

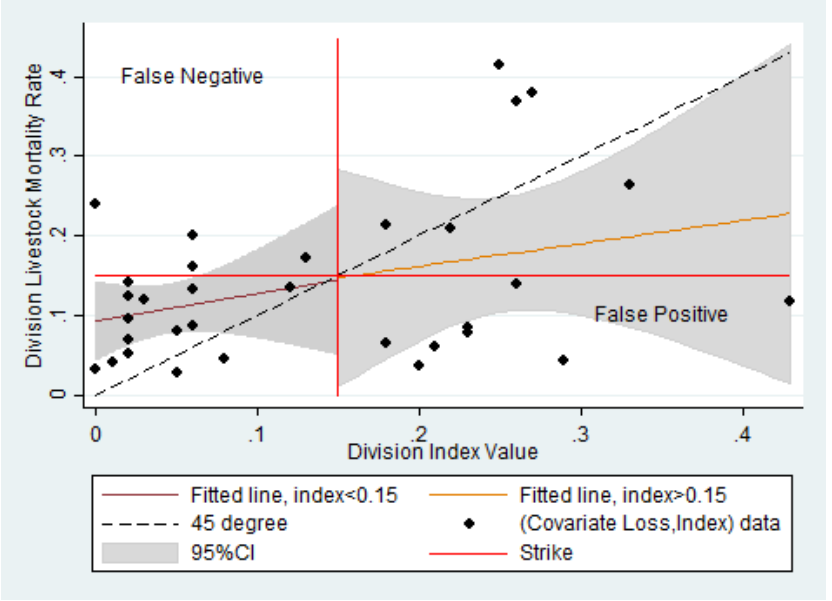
IBLI: Significant Basis Risk Remains

Covariate risk is important but household losses vary a lot …



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.

and the index does not perfectly track covariate losses.



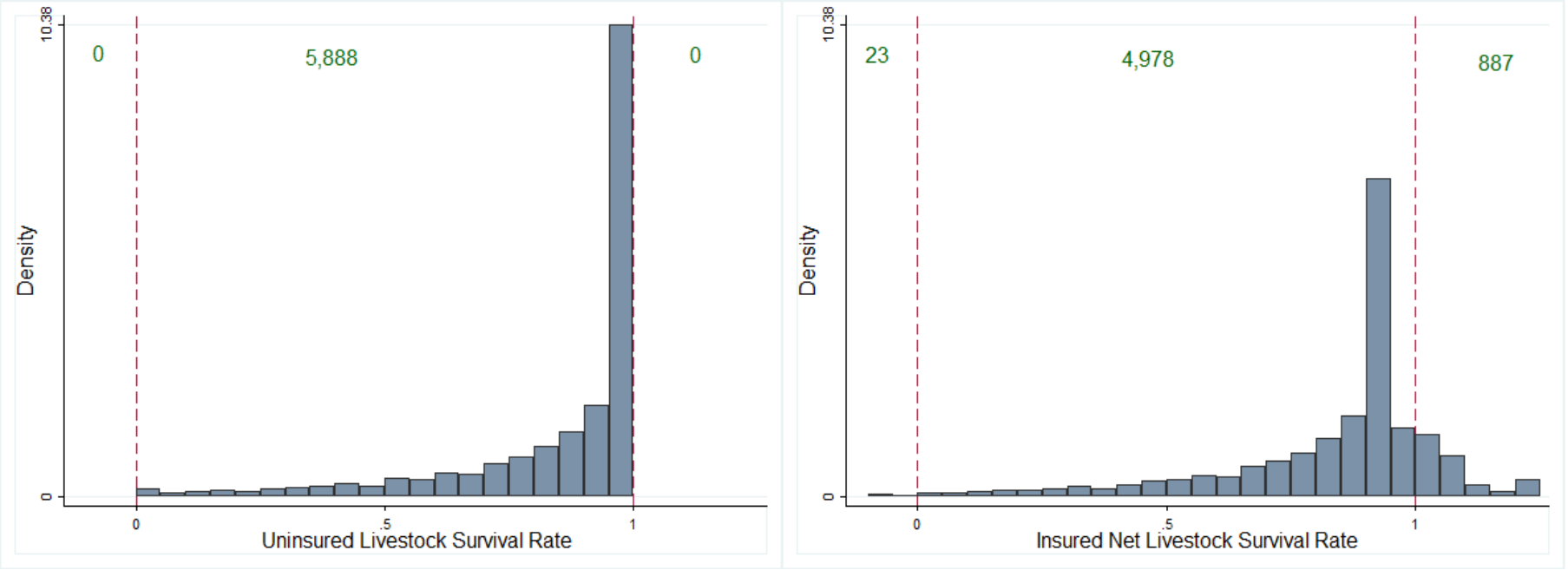
Notes: Covariate loss-index observations are seasonal division average mortality paired with the index value for that division-season. Fitted lines and confidence intervals are generated by regressing livestock mortality rates on the index.

- 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 spatial variation in covariate share – geographically target IBLI?

Jensen, Barrett & Mude 2014

IBLI: An Imperfect Product

Because of basis risk, esp. false negatives, IBLI cannot stochastically dominate no insurance.



Histograms of livestock survival rate and net livestock survival rate with full insurance. Tally to the left of zero, between zero and one, and to the right of one are in green.

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

Note: - small probability of negative survival rates!

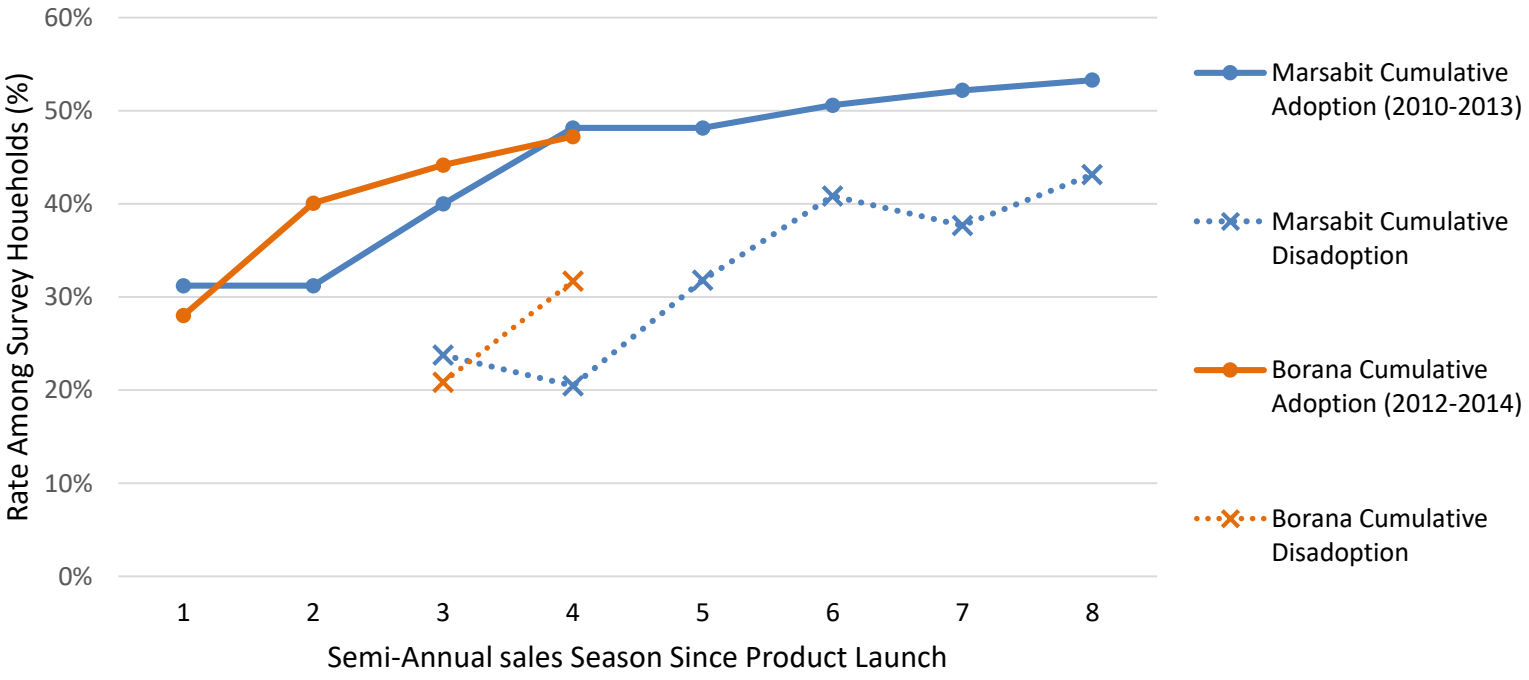
- increased dispersion of outcomes due to false payments>losses

Jensen, Barrett & Mude 2014

IBLI Uptake Significant … But So Is Disadoption

In HH surveys , in Borana (Ethiopia)/Marsabit (Kenya):

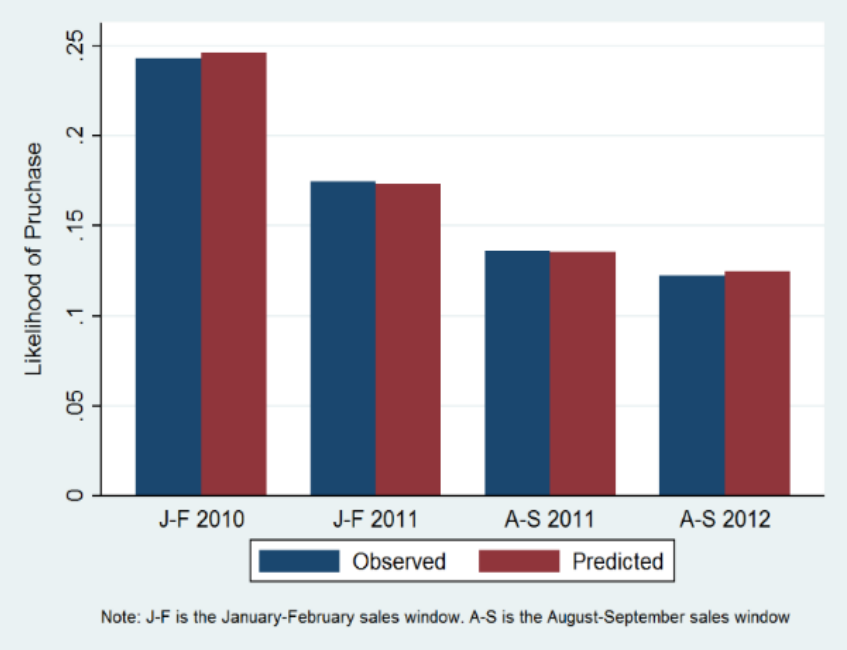
- 47/48% ever purchased IBLI within first 4 sales periods
- But repurchase rates low: 18-68%/16-27%
- High rates of disadoption : 20/31% within 2 years



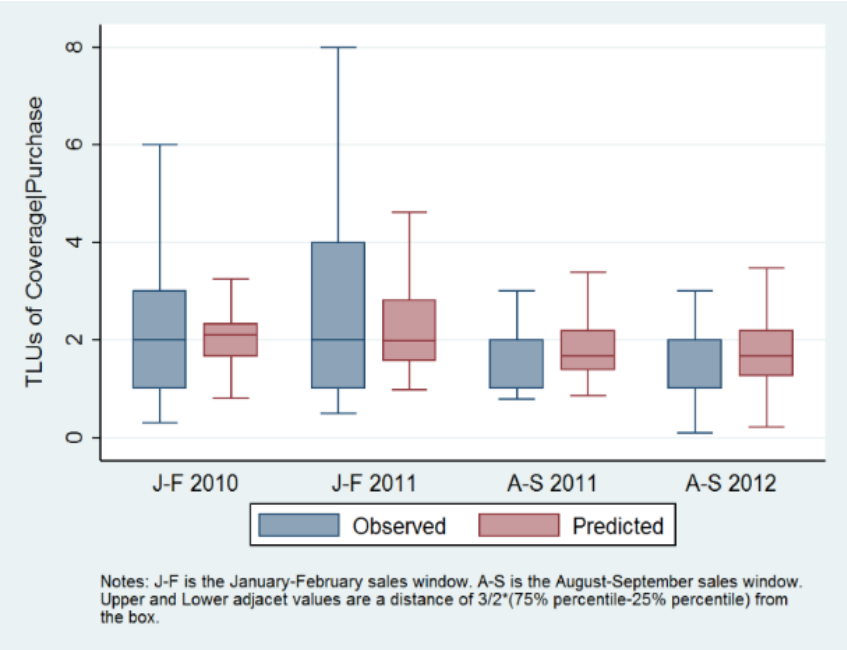
Sample restricted to 489/820 panel households.

IBLI Uptake Is Also Predictable …

Capacity to predict uptake patterns is reasonably strong:



Unconditional observed / predicted (Cond. FE) likelihood of buying IBLI



Observed / predicted (Cond. FE) level of purchases (|buying IBLI)

Key determinants of IBLI uptake

General uptake findings — robust across specifications and surveys

Price: Responsive to premium rate (price inelastic). Price elasticity grows w/design risk.

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

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

Spatial Adverse Selection: Divisions with relatively more covariate risk see higher uptake and level of coverage increases with variation in division average losses.

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

Bageant & Barrett 2015; Jensen, Mude & Barrett 2014; Takahashi et al. 2014

IBLI's Impacts: Herd mortality risk

Proportion of households for whom IBLI improves their position with respect to each statistic

Statistic	Proportion	
	Loaded & Unsubsidized	Subsidized
Mean	0.232	1.000
Variance	0.359	0.359
Skewness	0.817	0.817
Semi-Variance	0.374	0.609

Jensen, Barrett & Mude 2014

IBLI's Impacts: Livestock productivity/income

Dependent Variable	IBLI	
	Cumulative Past Coverage	Current Coverage (TLU)
Production strategies:		
Herd Size	-5.634***	-0.270
	(1.970)	(0.693)
		[3.543]
Veterinary Expenditures (KSH)	584.8*	-46.21
	(324.7)	(127.2)
		[15.17]
Household is Partially or Fully Mobile	-0.0669	0.0386
	(0.111)	(0.0481)
		[14.86]
Production outcomes:		
Milk income (KSH)	1,688*	840.6*
	(970.0)	(473.6)
		[11.46]
Milk income per TLU (KSH)	423.5***	63.81
	(118.1)	(47.23)
		[13.05]

A complete list of covariates, coefficient estimates, and model statistics can be found in Jensen, Mude & Barrett (2014). Clustered and robust standard errors in parentheses. Model F-stat in brackets. *** p<0.01, ** p<0.05, * p<0.1.

IBLI coverage:

- Increases investments in maintaining livestock through vet expenditures
- Increases total and per TLU income from milk.

Note: TLU veterinary expenditures are pos/sign related to milk productivity

Jensen, Barrett & Mude 2014

IBLI's Impacts: Less adverse post-drought coping

Marsabit HHs received IBLI indemnity payments in October 2011, near end of major drought. Survey HHs with IBLI coverage report much better expected behaviors/outcomes than the uninsured:

- **36% reduction in likelihood of distress livestock sales**, especially (64%) among modestly better-off HHs (>8.4 TLU)
- **25% reduction in likelihood of reducing meals** as a coping strategy, especially (43%) among those with small or no herds

IBLI appears to provide a flexible safety net, reducing reliance on the most adverse behaviors undertaken by different groups.

Janzen & Carter 2013 NBER

Insurance vs. cash transfers: Normalized by cost

IBLI generates comparable impact/KSh on average at pilot scale. But philanthropic/public funding is largely fixed cost, so the marginal benefit/cost ratios are *> an order of magnitude* larger!

Cost structure		Cost/ Participant	Income from Milk Impact	Income from Milk Impact/ Cost	Income per AE Impact	Income per AE Impact/ Cost[1]	MUAC Impact	MUAC Impact/ Cost[2]
Total Program	HSNP	47,600	992	0.021	394	0.083	1.097	0.022
Cost/Participant	IBLI	37,600	2,631	0.067	263	0.070	0.337	0.026
Marginal Cost of an	HSNP	31,700	992	0.031	394	0.124	1.097	0.033
Additional Participant	IBLI	1,580	2,631	1.667	263	1.666	0.337	0.623

All in real 2009 Kenya Shillings. Impacts are estimated using the average client value and costs from administrative records, and parameter estimates. [1]Results are multiplied by 10. [2]Results are multiplied by 1,000.

Jensen, Barrett & Mude 2014

IBLI's Impacts: Household subjective well-being

Borana survey HHs report overall life satisfaction. In principle, insurance helps risk averse people even when it doesn't pay out. But an imperfect product with commercial loadings might not.

There had been no payout in Ethiopia (pre-11/14). So use subjective well-being measures to assess welfare gains even w/o indemnities.

To deal with potential heterogeneity problems associated with SWB (attitudinal measures), we correct our SWB measures using hypothetical vignettes, using current best practice, and verify with alternative measures to ensure robustness of findings.

Tafere , Barrett, Lentz and Taddesse. 2014

IBLI's Impacts: Household subjective well-being

Use randomized treatments to instrument for IBLI and then estimate how IBLI contracts in force and lapsed IBLI coverage affect SWB.

There are at least two ways IBLI can influence SWB:

1) Non-monetary (psychological) benefits or costs
   - Insurance may give peace of mind about adverse outcomes
   - Insurance could increase stress if basis risk is high
   - Buyer's remorse wrt lapsed contracts

2) Monetary benefits or costs – effect on net income/wealth
   - Since premium payment reduces net income/wealth, indemnity payment increases it, net indemnity payments will influence SWB.

Tafere, Barrett, Lentz and Taddesse. 2014

IBLI's Impacts: Household subjective well-being

Key Findings:

- IBLI has a positive, stat. sig. effect on HH well-being, even after premium payment and w/o any indemnity payments
  - IBLI coverage for 3 TLU moves a HH 1 step up the SWB scale
  - Insuring 15 TLU (roughly baseline sample mean herd size) shifts HH from lowest to highest SWB category
- Ex post of contract lapse, purchasers exhibit some buyer's remorse in the absence of indemnity payments.
- But the positive effect of IBLI coverage is significantly higher than the negative effect of buyer's remorse.

Even with prospective buyer's remorse, IBLI purchase improves subjective well-being.

Tafere , Barrett, Lentz and Taddesse. 2014

Although IBLI offers incomplete coverage against herd loss and will not help all people, uptake is solid and privately-provided 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/