

Making index insurance work: A review of recent progress

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- Ample evidence that conventional insurance does not work for low wealth rural households (Ecuador)
- Evidence that index insurance can work:
 - *Before the Drought*
 - 20-30% increase in investment when insured (Ghana, India, Mali)
 - *After the Drought*
 - Significant reductions in costly coping strategies (Kenya)

The Problem,



- But uptake of index insurance is often low:
 - Low quality (failure-prone)
 - High price
 - Lack of trust in providers
 - Lack of information on a complex, novel technology (learning difficult)
 - Cash constraints to purchase
 - Behaviorally oddities (ambiguity aversion)
- Index insurance remains work in progress

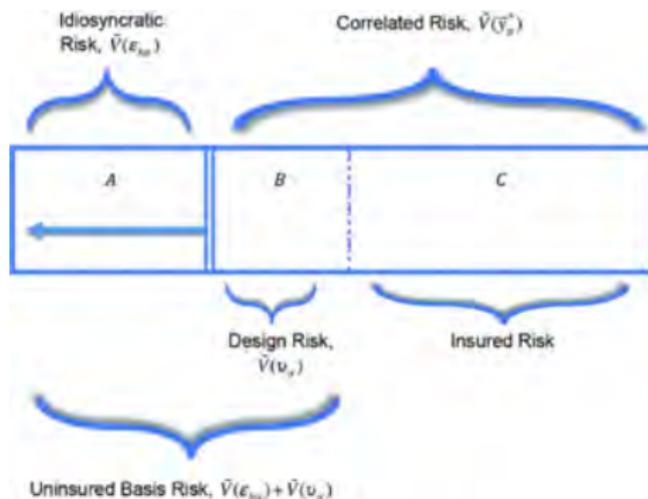
Progress toward Meeting Potential

- Our goal is to look forward & specifically focus on advances that might solve these problems
 - Ground-truthing & technological advances to create high-quality insurance indices
 - Safe Minimum Standards for index insurance quality to help create a viable market
 - Interlinked & meso-level insurance to overcome low uptake issues
 - [Contract design informed by behavioral economics]
 - [Smarter Subsidies that lower insurance costs & help make the market]
 - [Apply lessons from the microcredit revolution on outreach to low wealth clients]
- Alain will present alternatives to index insurance (stress resistant seed technologies; savings & credit instruments). These may be substitutes for insurance, but perhaps also complements as we can discuss later.

Insured & Uninsured Risk under Index Insurance

- Disappointed (angry) farmers & what are sometimes called “Basis Risk Events” have punctuated the importance of designing contracts that protect farmers
- Sources of uninsured risk are two:
 - *Design risk* occurs when an insurance index is poorly correlated with *average* losses in the insurance zone covered by the index; and,
 - *Idiosyncratic risk* occurs when the individual's losses differ from the average losses in her insurance zone.

Insured & Uninsured Risk under Index Insurance

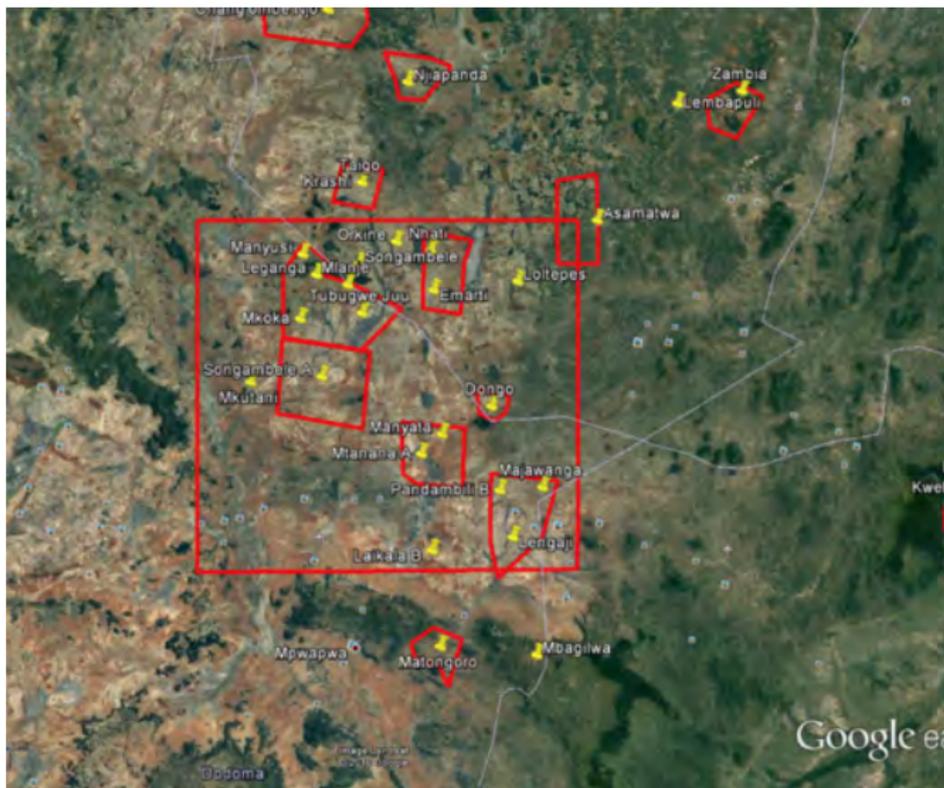


- Design risk can be minimized by improved contract design
- Idiosyncratic risk can be minimized by downscaling contract (subject to moral hazard constraints)
- Examine a recently implemented contract in Tanzania & Mozambique to illustrate design and implementation of a high quality contract

Contract Concept & Design

- Ongoing project in Tanzania and Mozambique is exploring the complementarity between index insurance and drought tolerant (DT) maize seeds that offer some protection against mid-season drought.
- Goal was to design a contract that offered protection against:
 - Early season rainfall deficit; and,
 - End of season yield deficit
- To this end, we collected current and retrospective maize yield data that would allow us to design a quality contract based on two satellite indices:
 - Estimated rainfall data to detect early season drought
 - NDVI (a bio-mass or “greenness” index) to measure yield deficit
- Measure each of these at the level of “contract zones, which comprise roughly 3 villages

Insurance Zones, Dodoma



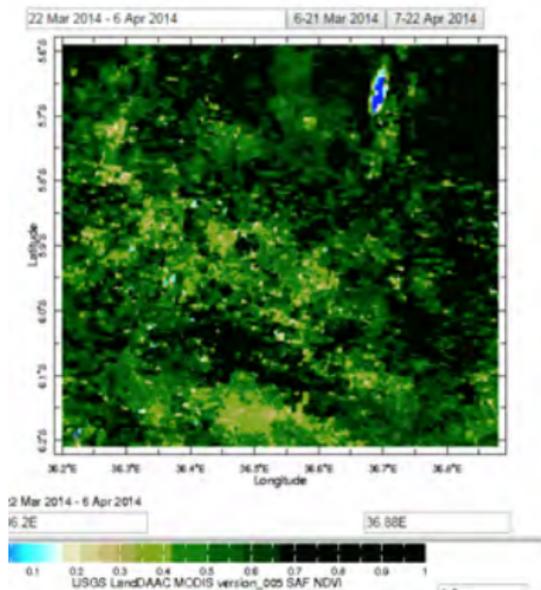
- Early season rainfall deficit trigger:
 - 5x5 kilometer (25 square kilometer) resolution
 - Data at 10-day (dekad) frequency
 - Use data to estimate planting date and then detect early season drought
 - Contract triggers payment if estimated rainfall below 90 mm over the first 40 days of the growing season

- Yield shortfall trigger based on Normalized Difference Vegetation Index (NDVI)
 - Measures biomass growth over the maize growing season
 - Data available on 250 m x 250 m grid (6 hectares) since 2002
 - Crop masking used to discard pixels that are not maize
 - Contract Triggers if predicted yields are less than 65% of their long-term average
- Optimized statistical model explains 80% of zone variation in yields (still some design risk)
- Scope for improvement with downscaling & ultra-high resolution data from Planet Labs (3mx3m)

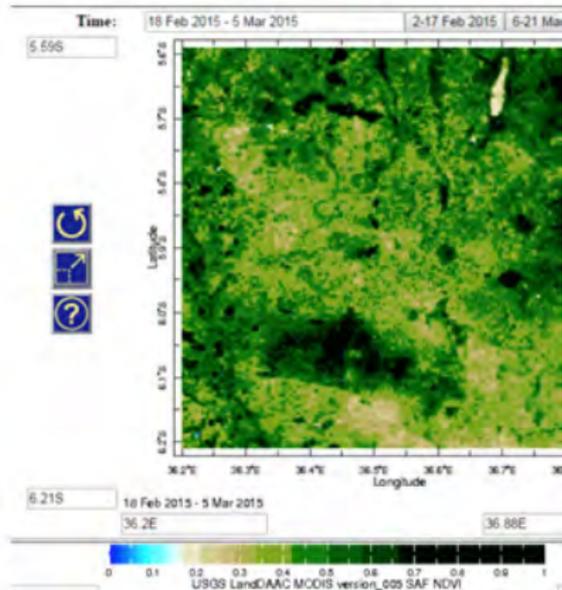


Index Design: NDVI

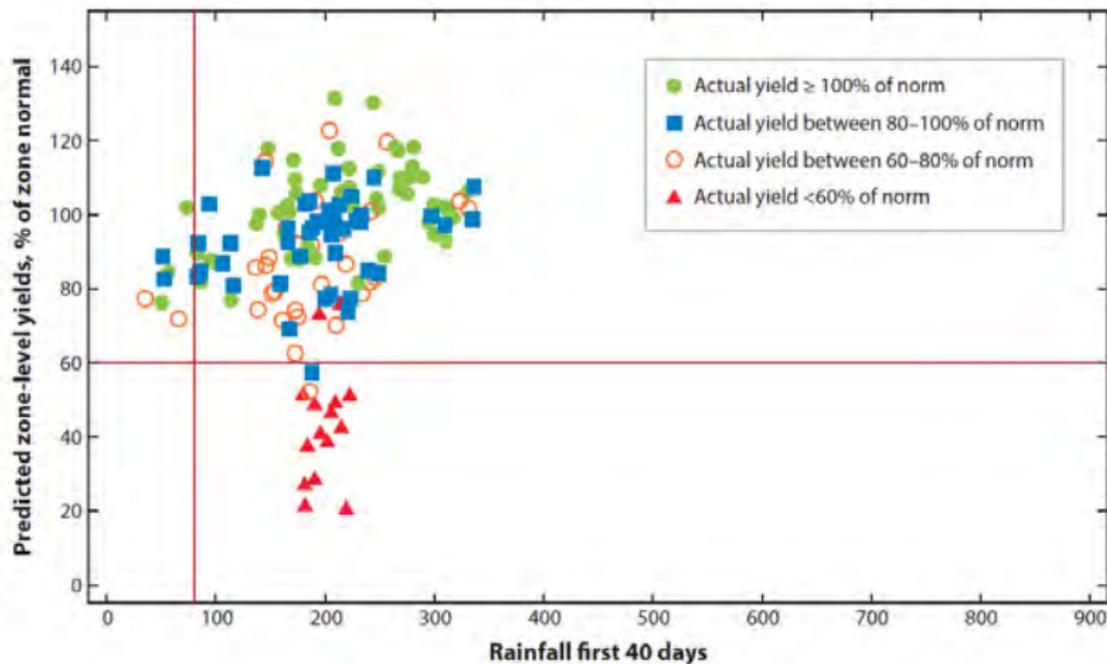
2014 (Planting 11 Jan, 2013)



2015 (Planting 1 Dec, 2014)



Overall Contract Performance



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- An on-farm audit can occur if farmers experience yield losses that are not predicted by the satellite data:
 - Farmers are notified 100 days after planting if insurance payout will occur in advance of harvest;
 - Farmers may then call for an audit if they believe the insurance did not properly cover their losses
- Audit triggered if at least 50% of farmers complain
- Camera-based audit is conducted by a team trained by CIMMYT crop officers from the Ministry of Agriculture

Example Pricing Table

Price of Insurance Contract (PRELIMINARY)		
	1 Acre (8 Kg of Seeds)	Per 2 kg Bag
<i>Contract Element</i>		
• Rainfall Deficit (5%*\$16)	\$0.80	\$0.20
• Yield Shortfall (16%*\$16)	\$2.56	\$0.64
• Audit Rule	\$1.15	\$0.29
	\$4.51	\$1.13
<i>Total Pure Premium</i>		
	\$5.63	\$1.41
Market Price Assuming 25% Mark-up		

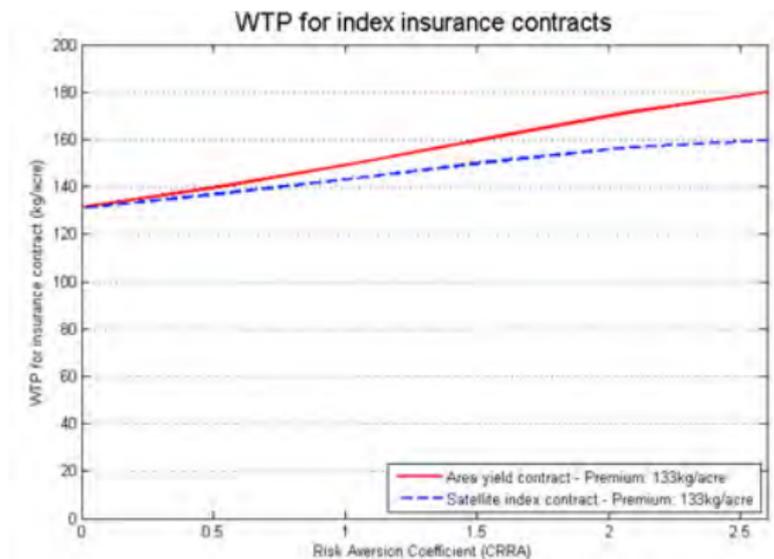
Safe Minimum Standard (SMS) for Index Insurance

- A quality index insurance contract is one that:
 - Adequately protect farmers against income fluctuations; and,
 - Can achieve the objectives we seek in offering insurance to developing country farmers (the before & after the drought effects summarized above)
- Like hybrid maize seeds, quality of index insurance :
 - Is a hidden trait (that is, the farmer can look at the contract paper & tell if it will protect her)
 - Costly to develop and supply
- Unlike hybrid seeds:
 - No defined & enforced quality standards (akin to germination & yield tests for seeds)
 - Takes many years for farmers to discern quality
- Given these characteristics, economic theory suggests unregulated market can reach a junk equilibrium with low quality insurance and low demand

SMS for Index Insurance

- Using the data collected for contract design, standard economic concepts allow definition of a “Safe Minimum Standard” for index insurance quality
- Two things reduce the quality of an index insurance contract:
 - The probability that an insurance failure happens
 - The “value” of money when failure happens (money worth more when need it most)
- Standard economic theory can aggregate these two elements into a single a 'reservation' price measure defined as the maximum amount an individual could pay for a contract without making herself worse off
- The Safe Minimum Standard is thus:
 - $\text{Market Price} < \text{Reservation Price}$ for a moderately risk averse farmer
 - If the market price exceeds the reservation price, then the individual would be better off having no insurance and keeping the premium money (even if subsidized)

SMS for Index Insurance



- Example of SMS analysis from a fail-safe contract designed for rice farmers in Tanzania
- Industry not yet pushing for such standards
- A first step might be for donors to demand that projects they fund meet the SMS

Interlinkage & Meso-level Insurance

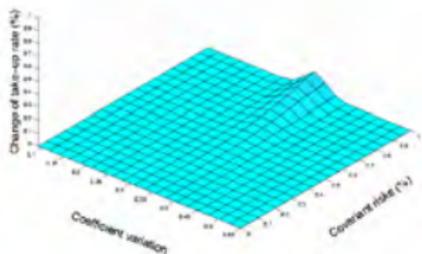
- Low insurance demand by individual farmers has encouraged the development of interlinked & meso-level products:
 - An interlinked contract is one in which insurance is bundled with another service, such as an agricultural loan through a bank or an agricultural value chain (e.g., required as a condition of a loan) and the creditor has first claims on insurance payoffs to cover debts
 - A meso product is where the insurance is purchase directly by the bank (or other meso-level institution) as portfolio protection

- Important to emphasize two things about interlinked & meso-level insurance:
 - Index quality remains paramount as large design risk (common risk that is NOT covered adequately by the contract) will sink even a meso-level contract
 - If a goal of insurance is to enable farmers to prudentially invest more in their agriculture, knowledge, understanding and protection under the meso-contract remain important

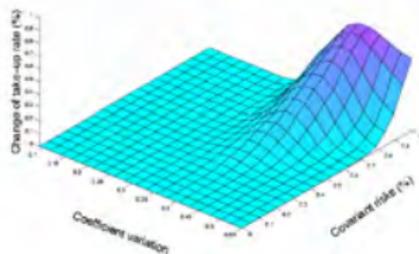
Interlinkage & Meso Insurance

- An interlinked contract is one in which the creditor has first claim on insurance payouts to cover farmers' debt obligations
- Interlinkage makes most sense in environments where loans are undercollateralized
- When loans are undercollateralized, lender bears drought and other risk
- Often the case in value chain finance where a standing crop partially collateralizes the loan
- Let's look at results from a theoretical analysis (Carter et al.)

Interlinkage & Collateral



(a) Standalone Insurance



(b) Interlinked Insurance

- In low collateral environments, standalone insurance contracts will have minimal impact on investment profitable activities
- Requiring standalone insurance can reduce investment!
- Interlinked insurance interlinked can crowd in investment if:
 - The loan market is competitive and the lender reduces interest rates on interlinked loans
 - Farmer knows that she is only liable for residual loan liability not covered by insurance payouts
- Note also that even interlinked insurance will have zero impacts if contract quality and, or total risk are low

- Mixed experience with interlinked credit:
 - High insurance uptake (30-70%) in value chain/loan programs in Kenya (sugar cane) and Mali (cotton), with significant investment impacts in Mali
 - Minimal uptake in Ethiopia (grain crops) and Burkina Faso (cotton), largely because of complex implementation problems
 - In Ghana, presence of interlinkage increased loan approval rates for male farmers (a supply-side effect), and yet for at least women farmers, insurance demand higher when insurance payments went directly to them (non-interlinked) rather than to the lender

- Problems of risk & resilience more powerful than ever
- Time to neither praise nor bury index insurance
- Technological frontier is exciting, but we need more attention to the designing contracts for quality
- Governments & donors can support the development and implementation of quality standards
- Can also promote portfolio thinking which flexibly that combines financial and agronomic risk management technologies in flexible ways that evolve over time for individuals

Thank You!



Insurance Pricing & Subsidies

- As SMS diagram shows, even quality index insurance cannot meet the SMS if price is marked up by much more than 40% of “actuarially fair price”
- While US crop insurance is marked up by ~27% (and then subsidized), not unusual in our projects to see mark-ups well above 50%
- Reasons behind these mark-up levels can be disputed, but clearly has some basis in concerns about data quality (sparse data problem) and climate change (unstable probability distributions)
- One interpretation is that these factors result in an uncertainty loading or mark-up

Insurance Pricing & Subsidies

- What is clear is that demand for, and impacts of, index insurance will be minimal at this price
- Been some tendency to simply to subsidize a highly marked-up price (the original GIIIF program run by IFC)
- A smarter subsidy might be for a public entity to carry some of the “tail risk” (about which there is uncertainty) so that the overall price comes down
- A just announced GIIIF program takes some first steps in this direction
- Also, can use subsidies to help make the market by providing a catastrophic level of protection
- Still much to be done to improve the use of subsidies so that index insurance can have its desired effects & promote resilience

- *Main lessons from microfinance:*
 - Microcredit increasingly customized to client circumstances:
 - Flexible collateral arrangements:
 - crops, warehouse receipts, assets purchased
 - Account for seasonal distribution of farmer income
 - Role of nudges and social incentives (joint liability)
- *Lessons for index insurance:*
 - Promote Village Insurance Savings Accounts (Nepal):
dedicated savings for health and weather index insurance
 - Pay premium at time of delivery of product: part of contract with buyer of crop (used in cotton, dairy & sugar value chains/contract farming schemes)
 - Include index insurance premium in price of inputs (Syngenta)