Dynamic Field Experiments & Index Insurance Comprehension:
Risk valuation in Morocco, Kenya & Peru

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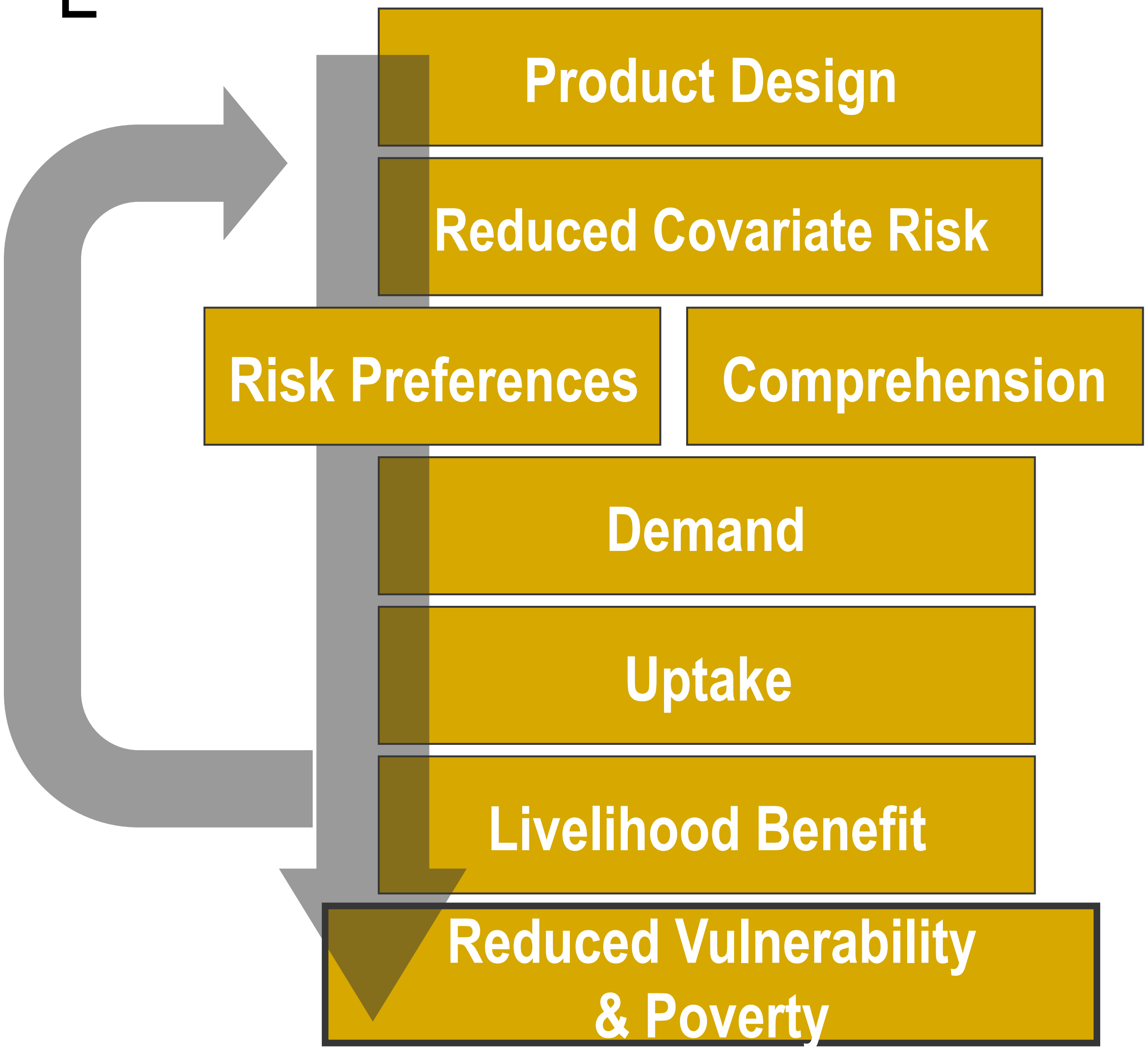
Index Insurance Benefit Chain



Index Insurance Benefit Chain

Product Design

Reduced Covariate Risk

The "build it and they will come" short cut

Uptake

Livelihood Benefit

Reduced Vulnerability & Poverty

Index Insurance Benefit Chain

Economic Experiments

Product Design

Reduced Covariate Risk

Risk Preferences | Comprehension

Demand

Uptake

Livelihood Benefit

Reduced Vulnerability & Poverty

Overview

OBJECTIVE

Explore in detail the use of economic experiments:

- To build comprehension among prospective beneficiaries
- To better understand their valuation of risk and risk reduction
- In order to improve the design and delivery of index insurance

OUTLINE

Risky Benefits: Discuss stochastic relative benefit streams, their dynamic implications, and the comprehension and valuation challenges they can pose to the rural poor

Experiments: Introduce economic experiments as a means to assess risk valuation, including those with built-in dynamics

The Paper: Describe and analyze dynamic risk experiments conducted in ***Morocco, Kenya*** and ***Peru***

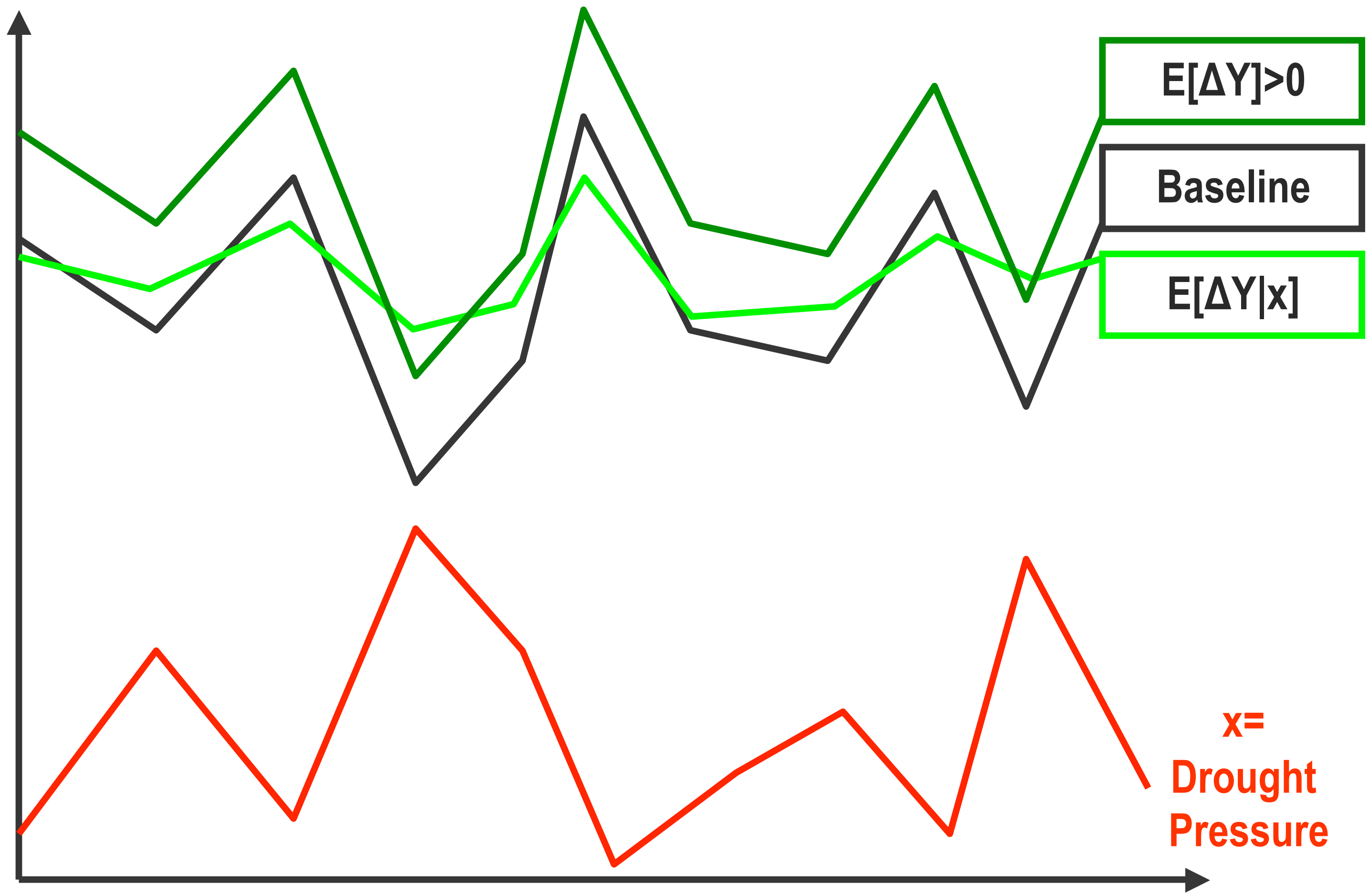
Discussion: Offer concluding thoughts about the merits and limitations of economic experiments in the ‘index insurance benefit chain’

TAKE HOME: Economic experiments can be an effective tool for building comprehension of index insurance, assessing risk preferences and potential demand

Risky Benefits in India

- Bt cotton provides important 'higher moment benefits' that are quite different than classic first moment yield improvements
- Many other crop traits in the pipeline confer similar higher moment benefits
- *Will poor farmers value pro-poor seeds that reduce production risk? Implications for delivery and uptake?*

Stochastic Relative Benefits & Welfare Dynamics



Dynamic Benefits: Safety & Cargo Nets

- With asset dynamics, targeting social protection can be key (Barrett et al. 2008)
  - **Safety nets** can protect the poor from falling below dynamic asset thresholds
  - **Cargo nets** may be needed to lift the persistently poor above dynamic asset thresholds
  - ***The dynamic efficacy of transfers can be heavily conditioned on the recipient's proximity to critical thresholds***

Taxonomy of Economic Experiments

“Experimental Economics”

Type	Context	Setting	Control
Conventional Lab Experiment	Abstract	Lab	Direct
Artefactual Field Experiment		Field Lab	
Framed Field Experiment	Familiar		
Natural Field Experiment (RCT)		Natural (subjects unaware of participation)	Indirect (via third party)
Natural Experiment			None

Experimental Economics in the Field

Used to simulate ‘incentive compatible’ economic behavior in a controlled and relevant environment

Guiding Principles

1. Real incentives
2. No deception
3. Framing & context in field experiments
4. Repetition to allow learning

Field Experiments in Development

- Binswanger's (1980) coin toss risk experiments
- Pender's (1996) delayed rice gifts and discount rates
- In 2000s:
  - Standard lab experiments taken to the field: Risk (EU v CPT), public goods, norms of fairness and punishment, etc.
  - Framed field experiments: Microfinance, technology adoption, etc.

Dynamic experiments

- Explicit linkages across experimental rounds
  - Cumulative earnings in an account
  - Reputation building across rounds
- A dynamic threshold changes key payoff parameters at a known point in endowment or earnings space
- E.g., Microfinance field experiments:
  - Future loans conditioned on past repayment → Dynamic incentives
  - These may matter more than group loans, monitoring, etc. (Abbink et al. 2006, Gine et al. 2009)
  - Individuals' response to these dynamic incentives is positively correlated with their 'static' risk preferences (Gine et al. 2009)

Why Index Insurance Experiments?

- So prospective beneficiaries can better understand products with stochastic and/or dynamic benefits
- So we can understand their valuation and potential demand and refine product design and delivery accordingly
- If we think index insurance can provide dynamic benefits, we should consider valuation in a dynamic settings

Objectives by Location

	Project Objective	Team
Morocco	Assess drought risk & valuation of drought tolerance	**UCD**: T.Lybbert, Y.Kusunose, N.Magnan, J.E.Taylor **INRA**: A.Fadlaoui, R.Mrabet **ICARDA**: A.Aw-Hassan **CIMMYT**: E.Meng
Kenya	Assess feasibility & valuation of NDVI index insurance	**Cornell**: C.Barrett, P.Chantarat **Syracuse**: J.McPeak **ILRI**: A.Mude **Wisc**: M.Carter
Peru	Assess feasibility & valuation of area yield index insurance	**UCD**: S.Boucher, C.Mullally **Wisc**: M.Carter, F.Galarza

On Location: Morocco

Obj: Assess drought risk at HH level and valuation of drought tolerant crops

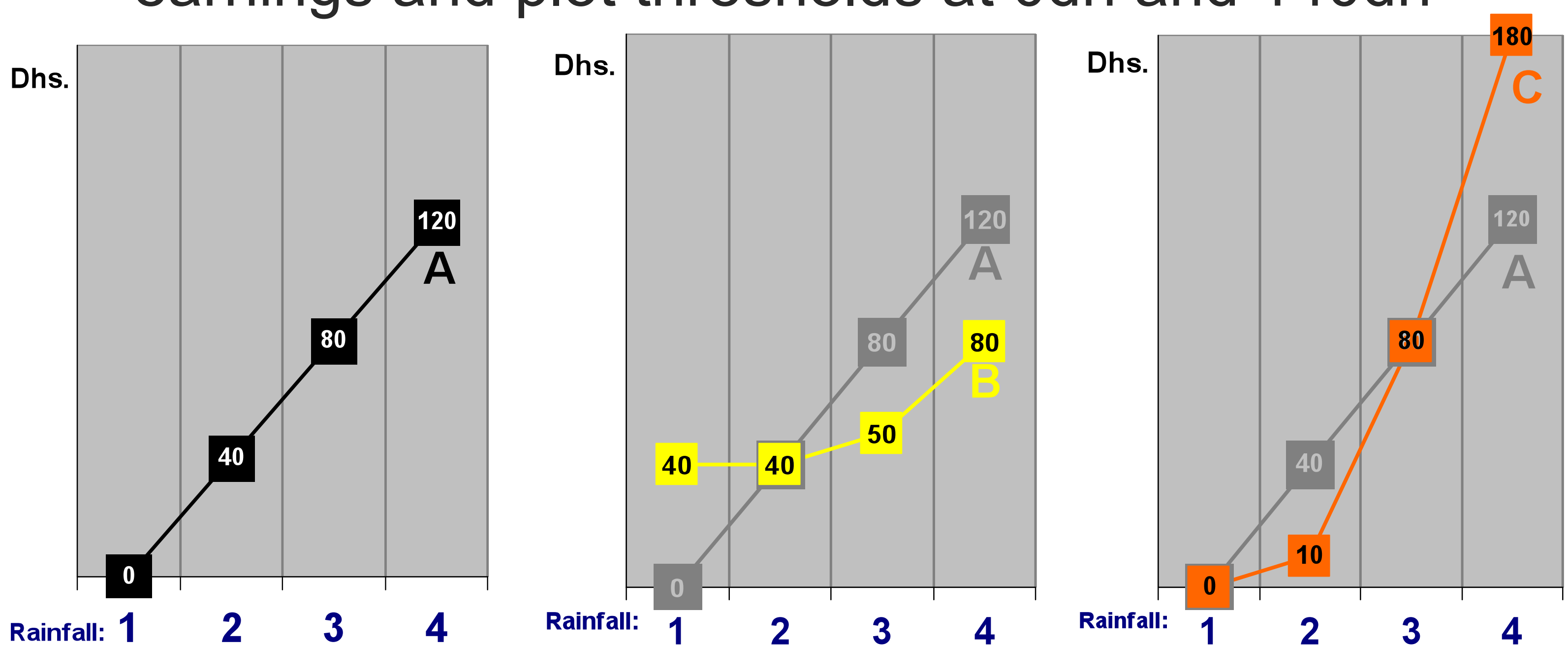
Data Collection Structure

- 20 villages in rainfed cereal production
- Initial sample size 290 HHs

Summer 07	Summer 08	Season 08–09
Village survey Detailed HH survey Economic experiment	Village survey Detailed HH survey	SMS survey (2/mo.)

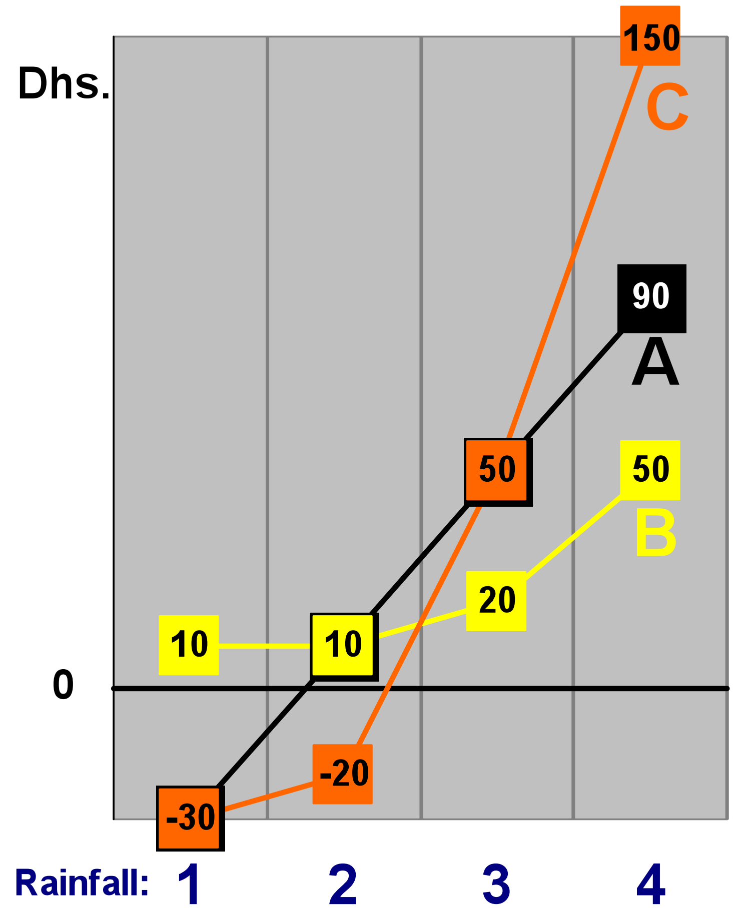
Experimental Design

- Valuation of payoff distributions, i.e., ‘seed types’
  - Open-ended valuation via BDM
  - Dichotomous ‘seed’ choice
- Static, then dynamic rounds with cumulative earnings and plot thresholds at 0dh and 140dh

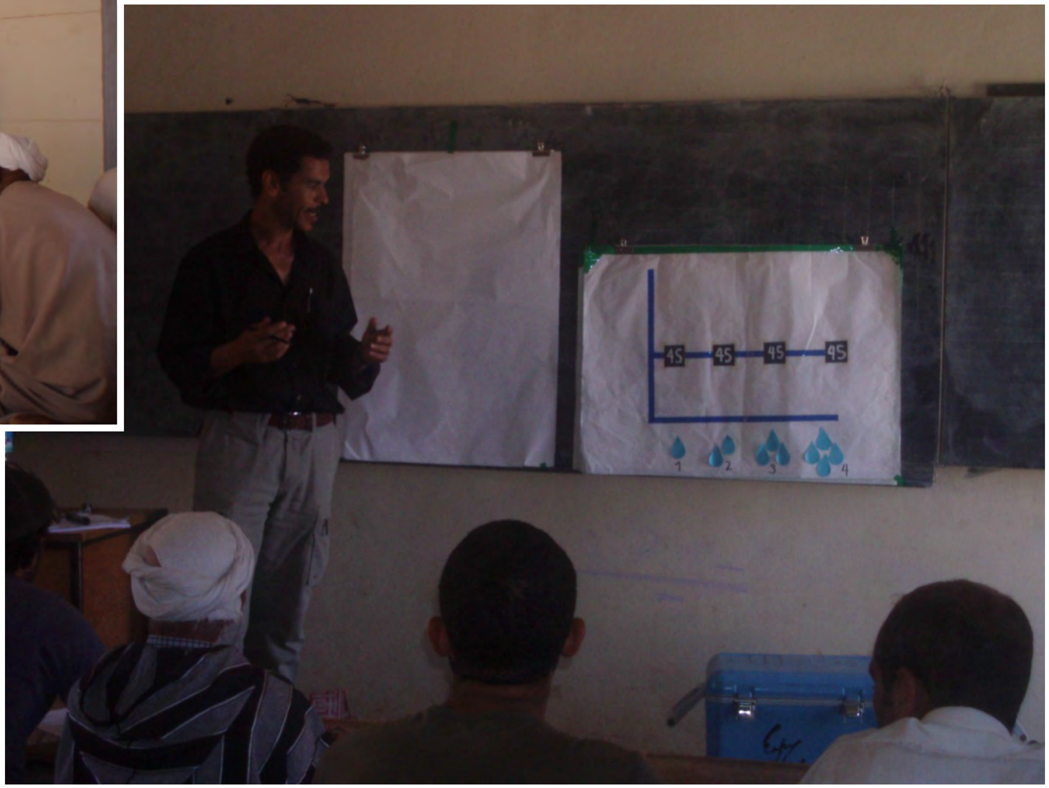


Context, Calibration & Comprehension

- Contextualizing risk
- Calibrating payoffs
- A familiar context with well-calibrated payoffs can improve comprehension
- But presentation and practice are still critical



Conducting the Experiment



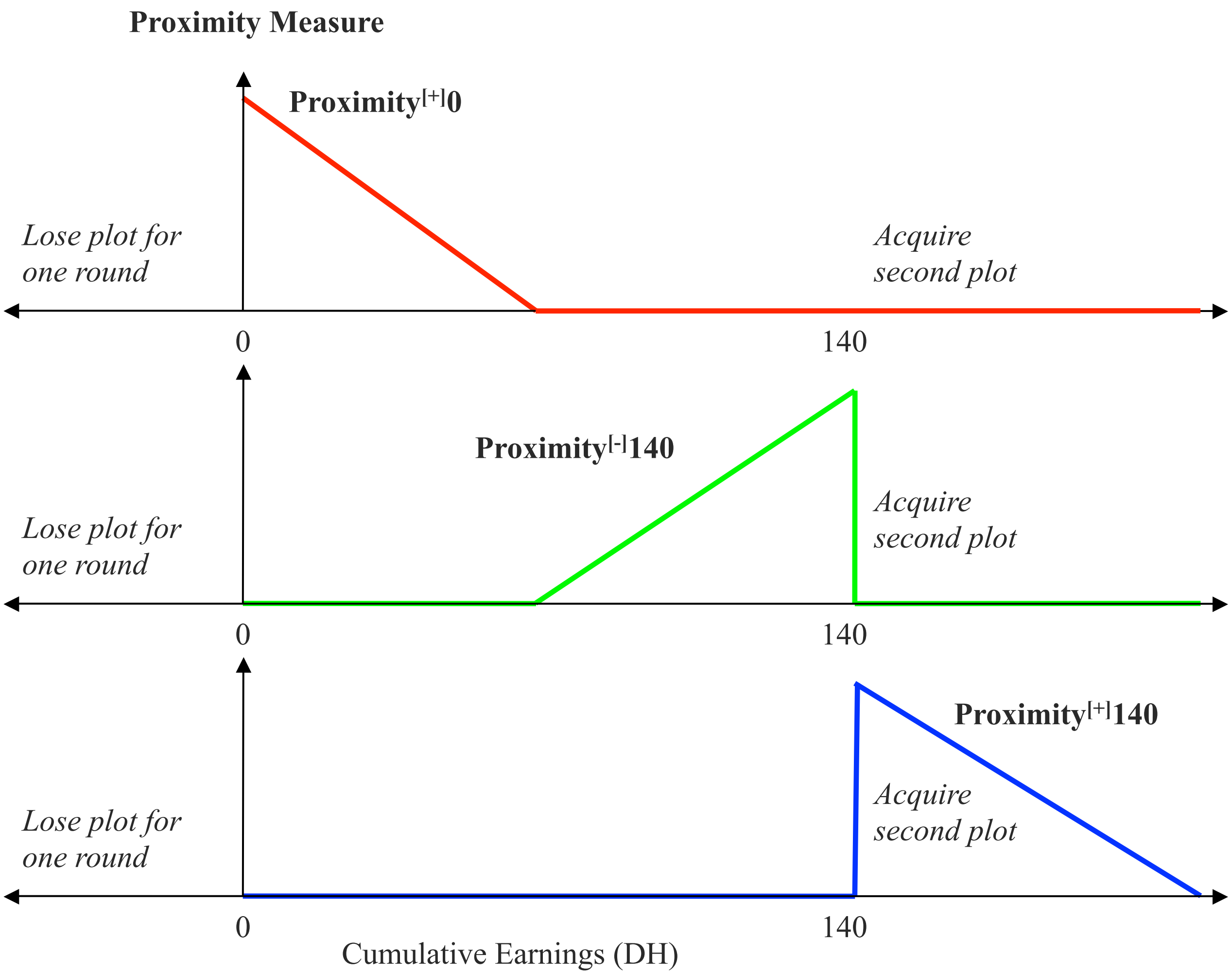
Practice then high-stakes rounds

WTP for each seed in isolation

Choice between seeds (static)

Choice between seeds (dynamic)

Dynamic Treatment Effects



Dynamic Treatment Effects

- We estimate an ordered Probit model of seed choice in dynamic rounds
- Key results
  - Evidence of dynamic risk response both above 0dh (greater risk aversion) and below 140dh thresholds (greater risk seeking)
  - Risk taking with second plot
  - Proximity interacted with static risk aversion→ dynamic risk seeking just below threshold is magnified by static risk aversion

On Location: Kenya

NDVI-based index insurance for Kenyan pastoralists

Experimental Design

- Starting period herd sizes randomly assigned: 6, 8, 10 Tropical Livestock Unit
- Shared risk determined by a ball drawn from a bag with 16 balls, each ball is a rainy season – dry season pair:
- This shared risk is adjusted for each person based on the individual risk draw

-30%	-20%	0%	10%	20%
(1/16)	(1/16)	(2/16)	(7/16)	(5/16)

☹	😐	☺
Ball-10%	Ball+0%	Ball +10

Experimental Design

- Five sets of rounds
  1. Covariate risk only (“pasture quality”)
  2. Individual risk only (“luck”)

     Covariate and individual risk
     3. Without insurance
     4. With insurance
  5. Covariate and individual risk with <u>chosen level of insurance</u>
- Subjects paid according to end-of-round herd size in randomly drawn round from set 5

Actual Asset Dynamics

- With nonlinear asset dynamics, insurance may be especially valuable to the poor
- Payoffs in experiments can be linked across rounds in a way that captures the essence of such dynamics
- This can facilitate comprehension and better assess risk attitudes and ultimately demand
- There exists a dynamic threshold at ~7 TLU
- Herders are aware of the threshold
- To replicate these dynamics impose
  - A fixed consumption requirement of 0.5 TLU per round
  - An appropriately calibrated herd growth rate Random starting herd sizes

Experimental Asset Dynamics

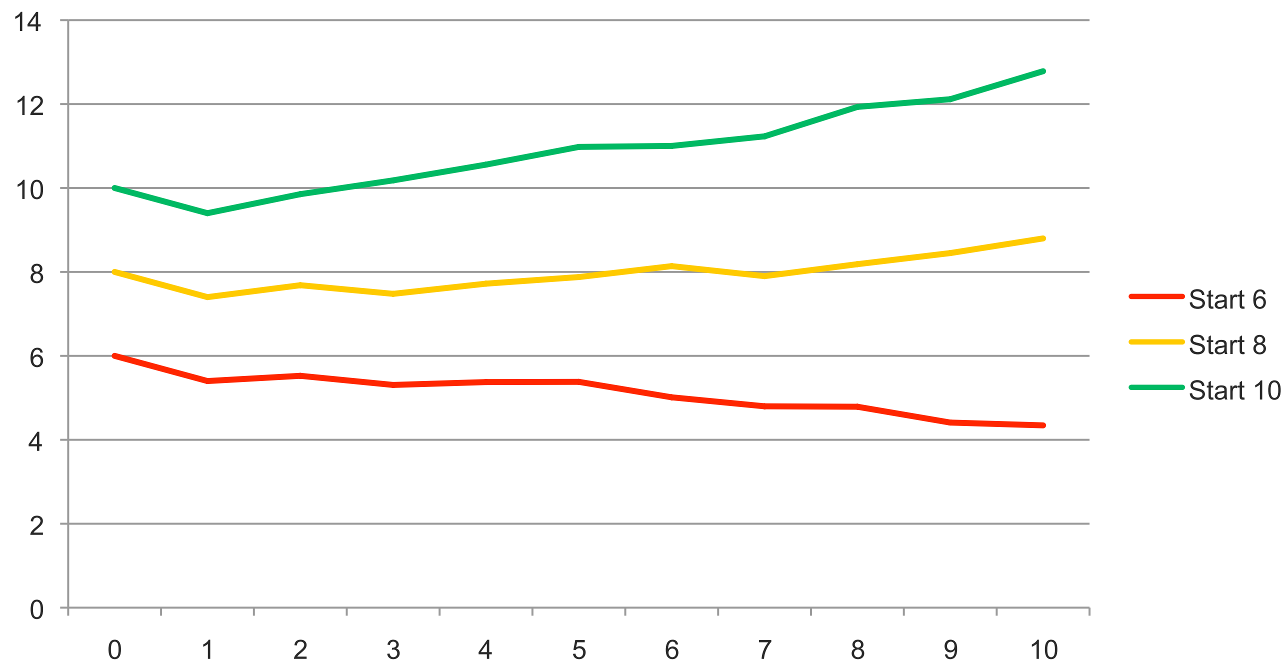
- To replicate these dynamics in the experiment impose
  - A fixed consumption requirement of 0.5 TLU (5 sheep or goats) per round
  - An appropriately calibrated herd growth rate
  - Random starting herd sizes
- → E(herd growth)<0 below 6.6 TLU
  E(herd growth)>0 above 6.6 TLU

Conducting the Experiment

5 Locations

207 participants

Dynamics & Dynamic Response

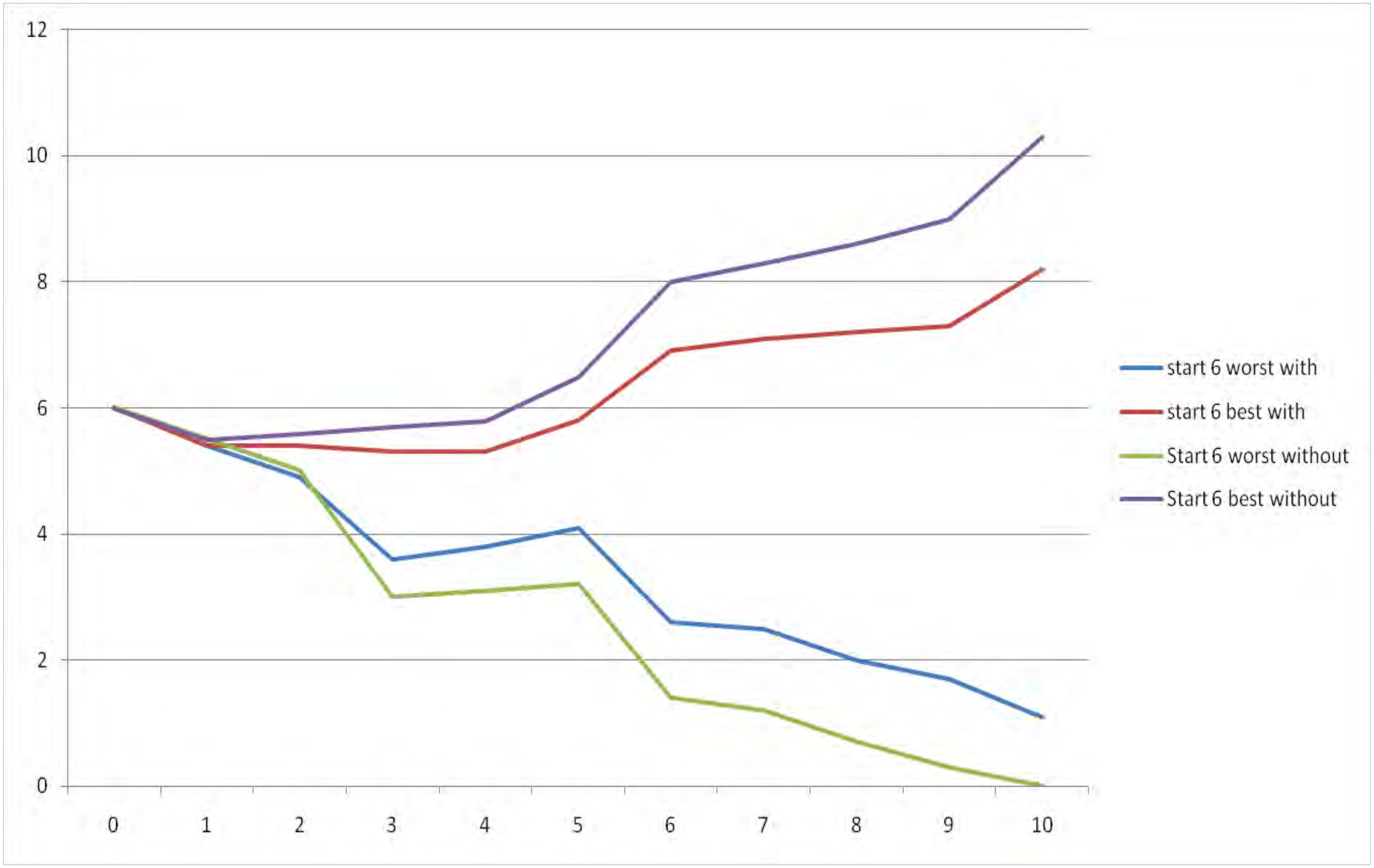


- During the experiment, the subsistence requirement seemed to capture a mechanism behind non-linear herd dynamics that was familiar to the subjects
  - Some pleaded to be able to ‘go hungry’ in a given round in order to keep their herd above ~7 TLU

Dynamics & Dynamic Response

	Mean herd size 'with' greater than 'without'	Mean variance in herd size across rounds 'with' versus 'without'	Mean share of herd insured across rounds	t-statistic on test of different means*	
				6 – X	8 - 10
6 TLU start	+3%	-40%	81%	-	-
8 TLU start	+2%	-29%	78%	2.40	-
10 TLU start	+3%	-22%	68%	8.47	6.45

Building Comprehension



Determinants of Insuring

Table 5 Tobit estimation results for fraction of herd insured in Kenya

	Coefficients	Std Errors
Round number (2,3,…,10)	0.012***	0.0046
Dirib Gumbo dummy	0.11***	0.0378
Karare dummy	0.13***	0.0346
Kargi dummy	0.14***	0.0354
North Horr dummy	0.09**	0.0365
Start 6 TLU dummy	1.25***	0.0771
Start 8 TLU dummy	1.38***	0.0938
Start 10 TLU dummy	1.39***	0.1022
Beginning round herd size	-0.0910***	0.0139
Beginning round herd size^2	0.0020***	0.0005
Covariate shock previous round	-0.0013*	0.0009
Idiosyncratic shock previous round	-0.0028**	0.0015
R^2:	0.47	
N (207 subjects x 9 rounds each):	1863	

Logologo is omitted site dummy. All three start sizes included instead of an overall constant. Estimated as double censored tobit model (45% (2%) of observations censored at 100% (0%) of herd insured). Subject fixed effects are not included so that start sizes can be.

*** (**) [*] denote significance at 5% (10%) [15%] levels.

On Location: Peru

- Area yield index insurance project
- 25,000 irrigated hectares
- Smallholder cotton dominates
- Natural risks
  - Drought
  - Excess rain (El Niño)
  - Temperature/pests

Experimental Design (Baseline)

- **<u>Project A</u>: Uninsured Loan**
  - Intensive cotton technology with loan
  - High return/high risk option
- **<u>Project B</u>: Self-Finance**
  - Low-intensity, cotton technology without loan
  - Low return/low risk option
- Farmer's Payoff in each round depends on
  - Project chosen
  - Valley-wide weather shock and Individual shock
  - Credit history (defaults reduce land value by 50%)
- 6 low-stakes rounds (learning), 6 high-stakes rounds

Experimental Design (Insurance)

- **Project A: Uninsured Loan**
- **Project B: Self-Finance**
- **Project C: Insured Loan**
  - Intensive cotton technology with loan
  - Area-yield insurance
- Farmer’s Payoff in each round depends on
  - Project chosen
  - Covariate and individual weather shock
  - Credit history
- 6 low-stakes rounds (learning), 6 high-stakes rounds

Calibration & Context in Peru

Fichas del Rendimiento Promedio en el Valle

Color de la Ficha	Rendimiento Promedio	Numero de Fichas
Negro	Muy Bajo (23 QQ)	1
Rojo	Bajo (30 QQ)	2
Blanco	Normal (37 QQ)	4
Azul	Alto (43 QQ)	2
Verde	Muy Alto (48 QQ)	1

Pelotas de la Suerte Individual

Color de la Pelota	Suerte Individual	Numero de Pelotas
Morado	Mala	1
Verde	Normal	2
Amarillo	Buena	1

PROYECTO C: ALGODÓN CON PRÉSTAMO Y SEGURO

Rendimiento promedio en el valle

Suerte	Muy bajo (23 QQ)	Bajo (30 QQ)	Normal (37 QQ)	Alto (43 QQ)	Muy alto (48 QQ)
	40	20	170	320	450
	110	110	280	440	590
	180	200	390	560	730

Calibration & Context in Peru

Conducting the Experiment

12 Locations

412 Subjects

Dynamic Treatment Effects

- Insurance can resolve risk-rationing, especially among relatively educated subjects

		Insurance Game				
		Uninsured loan (A)	Self-finance (B)	Insured loan (C)	Total	%
Baseline Game	Uninsured loan (A)	109	14	164	287	*75.9*
	%	*38.0*	*4.9*	*57.0*	*100.0*	
	Self-finance (B)	20	19	52	91	*24.1*
	%	*22.0*	*20.9*	*57.1*	*100.0*	
	Total	129	33	216	378	*100.0*
	%	*34.1*	*8.7*	*57.1*	*100.0*	

	MOROCCO	PERU	KENYA
Dynamic element of experiment	Subjects choose between the three 'seeds' for seven consecutive rounds with cumulative earnings. They lose their plot for one season (gain a second plot) if their cumulative earnings are below 0Dh (above 140Dh).	Subjects with uninsured loan face dynamic risk of default, which eliminated their access to credit in future rounds and depreciated the value of their land.	Subjects required to consume 0.5 livestock units each round, which creates positive (negative) expected herd growth above (below) 6.6 livestock units.
Effect of dynamic element	Farmers are conservative just above the 0Dh threshold and aggressive just below the 140Dh. Statically risk averse farmers are especially aggressive just below 140Dh. Farmers take greater risks with the second plot once they have it.	In pre-testing, losing land as default consequence too dominant as a dynamic incentive. 57% of risk rationed farmers opt for insured loan when available. Statically risk averse farmers tend to stick with self-financing.	Herders clearly understood the nonlinearity introduced by the consumption requirement. Mean share of herd insured higher for those starting below 6.6 threshold. Share of herd insured increases with initial herd size but decreases as herds grow, which requires linked rounds.

Summary

- With repeated seasons, subjects can appreciate stochastic and dynamic benefits
- In all three experiments, subjects' risk decisions respond to dynamics
- Connection to products and place provides a useful context to aid comprehension
- But complex experimental designs can still pose comprehension problems

External Validity of Dynamics?

- Within-subject design with both static and dynamic treatments imply that the dynamic treatment effect may be of interest even without strong external validity
- When building comprehension for a soon-to-be-released insurance product, external validity matters more…

  …but strong context with specific product strengthens context-specific external validity

  - E.g., ILRI getting calls from pastoralists wondering when NDVI insurance will be available
- External validity of experiments that elicit responses to broader, more general interventions conditional on poverty dynamics may be more challenging

Mobile Labs

- Computer-based platforms promising due to computational demands of dynamic experiments (especially when combined with other logistical challenges of conducting field experiments
- These can improve subject learning / comprehension
- Kenya part II
  - Local wifi linked netbooks
  - GameWeb software
  - Browser interface
  - Display of outcomes
  - Near real time feedback

Final Thoughts

- Economic experiments can be an effective tool for building comprehension of index insurance and assessing risk preferences
- Experiments *may* help to characterize demand for an insurance product – but only after comprehension is solid
- More complex production settings (higher risk dimentionality) raise important tradeoffs between basis risk and comprehension
  - *Once they understand index insurance, do subjects need to understand the mechanics or just the level of basis risk?*
- Even the best experimental design will require a cognitive leap to reality
  - The potential role of progressive locals, leaders, and suppliers
  - *Intra-seasonal index information sent via SMS?*

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Economic Experiments

Product Design

Reduced Covariate Risk

Risk Preferences

Comprehension

Demand

Uptake

Livelihood Benefit

Reduced Vulnerability & Poverty