Long-run Effects of Catastrophic Drought Insurance

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Motivation

- Uninsured catastrophic aggregate shocks have negative long-run impacts on well-being. (e.g., education, health, assets) (Maccini and Yang, 2009; Dinkelman, 2017; Shah and Steinberg, 2017; Carrillo, 2020).
  - When shocks occur, people may draw down productive assets and reduce human capital investment – with detrimental effects when it happens early in life (Jensen, 2000; Alderman et al., 2006).
  - Exposure to disaster risk may induce risk averting behaviors, discouraging investment in strategies that promote growth (Boucher et al., 2008; Karlan et al., 2014; Emerick et al., 2016)
  - In the presence of multiple equilibrium poverty traps, there might not be recovery (Lybbert et al., 2004; Kraay and McKenzie, 2014; Banerjee et al., 2019; Barrett et al. 2019; Balboni et al., 2022).
- Literature points to insurance market failures as an important source of the adverse impacts of catastrophic risk (Lybbert et al., 2004; Karlan et al., 2014; Barrett et al., 2019).
- ...but evidence on the long-run impacts of insurance lacking.

To what extent does insurance against catastrophic covariate shocks impact long-run household well-being outcomes?

What we do in this paper

- We investigate the long-run impacts of catastrophic drought insurance – index-based livestock insurance (IBLI) – **10 years after its initial introduction.**
  - 82% of the original panel households were re-interviewed.
  - Primary outcomes of interest include income, assets, productive strategies, and human capital accumulation. (Pre-analysis plan: AEARCTR-0011184)
- We use **randomized premium discounts** during initial years to identify the LATE of insurance coverage on pre-specified outcomes 10 years after initial IBLI exposure.
- We investigate robustness to potential spillovers, the dynamics of effects, and whether mechanism operates via *ex ante* coverage or *ex post* payouts.

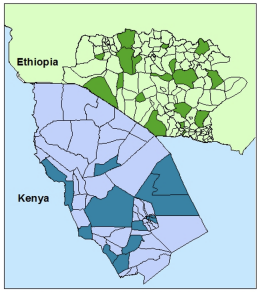
Setting: Northern Kenya (Marsabit) and Southern Ethiopia (Borena)

Livestock grazing and drought

- Pastoralists rely on extensive livestock grazing.
- Drought-related causes account for 47% of total livestock losses.

Risk management and self-insurance

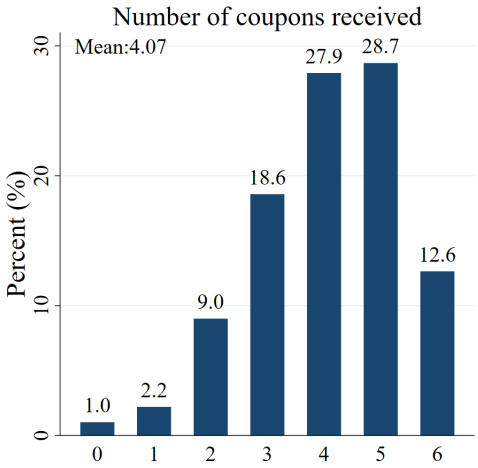
- Seasonal migration
- Inter-household gifts/loans insufficient for aggregate shocks; all are similarly affected.
- Aggregate shocks causes livestock prices to fall, so markets don't buffer against supply shocks.
- Prior to IBLI, formal finance was largely unavailable.

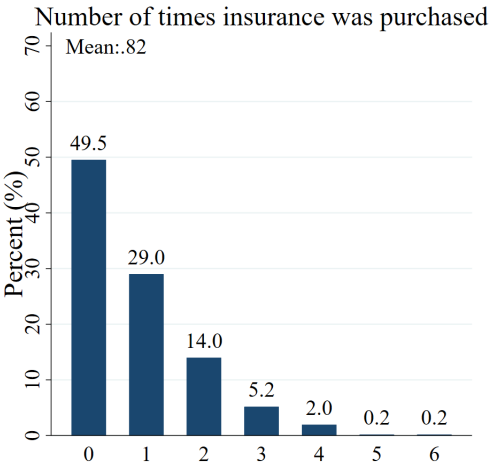


Research design

- Original study sample: 1,439 pastoralists from 33 locations.
  - Random samples from the population in each location, stratified by herd size.
  - Baseline survey conducted before IBLI was announced (Kenya 2009; Ethiopia 2012); panel surveys of the same households conducted annually up to 2015.
- Randomized discount coupons
  - Randomly selected households were given coupons with varying premium discount rates (10-80%) on purchase of coverage up to 15 TLU.
  - Non-transferable, expired at the end of semi-annual sales seasons.
  - Re-randomized in each of six sales seasons between 2010 and 2015.
- Follow-up surveys of original panel households in Kenya (2020) & Ethiopia (2022).
  - No surveys nor experiments conducted between 2015 and the long-term follow-up survey.
  - Insurers didn't sell in these villages post-2015.

Discount coupons and insurance uptake





▸ Correlation

Estimation strategy: First stage

We instrument IBLI uptake, I_{ij}, by the following first stage equation:

$$I_{ij} = \alpha_0 + \alpha_1 D_{ij} + \alpha_2 y_{ij0} + \alpha_3 X_{ij0} + \rho_j + \mu_{ij} \quad (1)$$

where I_{ij} is insurance uptake for household i, who lives in location j

X_{ij0} is a vector of baseline household characteristics

where insurance uptake (I_{ij}) and discount coupons received (D_{ij}) are defined as below:

$$I_{ij} = \begin{cases} 1 \text{ if there exists } t \in \{1,2,3\} \text{ such that } I_{ijt} > 0 \\ 0 \text{ otherwise} \end{cases} \qquad D_{ij} = \sum_{t=1}^{t=3} Z_{ijt}^{D} \text{ where } Z_{ijt}^{D} = 1 \text{ if } R_{ijt} > 0$$

where Z_{ijt}^{D} is an indicator for whether the respondent received a discount coupon in season t, and R_{ijt} is the discount rate.

Estimation strategy: Second stage

We estimate:

$$y_{ijT} = \beta_0 + \beta_{LATE}\widehat{I}_{ij} + \beta_1 y_{ij0} + \beta_2 X_{ij0} + \beta_3 D_{ij4}^{t=6} + \rho_j + \epsilon_{ijT} \quad (2)$$

where y_{ijT} is the outcome y for household i, who lives in location j, in sales season t,

$\widehat{I}_{ij}$ is the predicted insurance uptake from the first stage,

$D_{ij4}^{t=6}$ is the number of seasons a household received a coupon in seasons 4 to 6,

$t = 0$ refers to the pre-IBLI baseline; $t = T$ refers to the 10 year follow-up survey.

IV assumptions are satisfied

- **Exogeneity:** Randomization of discount coupons was successful. ▸ Balance
  - No significant differences or significant F-statistics.
  - Normalized differences are below the threshold of 0.25 in 46 out of 48 tests.
- **Monotonicity:** the likelihood of any IBLI take-up in the first three seasons monotonically increases with the number of coupons received in the first three seasons. ▸ Monotonicity
- **Exclusion restriction:** Since the instrument consisted of randomized discount coupons not transferable and only for the immediate season, violation is unlikely.
  - We check for violation of SUTVA/exclusion restriction under potential interhh spillovers.

No differential attrition by our instrument

- 82% of the households interviewed during the baseline (N=1,439) were re-interviewed at our 10-year follow-up (N=1,179).
- **Attrition is not differential** by our instrument, i.e., the number of times that they were randomized to receive discount coupons during the first three seasons. ▸ Differential attrition
- Overall, households that have fewer adults, or (weakly) female-headed or do not own agricultural land, were more likely to attrit from the sample. ▸ Selective attrition

First stage regression results

	Any insurance purchased – first three seasons						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No. of coupons received – first three seasons	0.122***						
	(0.016)						
Received coupon – first season		0.170***					
		(0.029)					
Received coupon – second season			0.069**				
			(0.030)				
Received coupon – third season				0.065**			
				(0.030)			
Received coupon – fourth season					0.002		
					(0.030)		
Received coupon – fifth season						-0.012	
						(0.030)	
Received coupon – sixth season							-0.046
							(0.035)
Controls	✓	✓	✓	✓	✓	✓	✓
Effective F-stat	56.223	33.963	5.272	4.791	0.003	0.151	1.688
10% Critical Value	23.109	23.109	23.109	23.109	23.109	23.109	23.109
N	1179	1166	1154	1165	1154	1151	1151

▸ All six seasons

Long-run effects of catastrophic drought insurance on herd composition

	Outcome: N of animal type in CMVE / Total N of animals in CMVE					
	Camel	Cattle	Goats	Sheep	Camels & cattle	Goats & sheep
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased	0.106	0.107	-0.215**	0.005	0.213*	-0.213*
	(0.089)	(0.081)	(0.094)	(0.051)	(0.112)	(0.112)
Controls	✓	✓	✓	✓	✓	✓
Control mean	0.255	0.311	0.293	0.141	0.566	0.434
Observations	987	987	987	987	987	987

▸ N of animals - by each species ▸ N of animals - by baseline quantile
▸ All seasons IV
▸ Income ▸ Income - total livestock and crop
▸ Prespecified primary I ▸ Prespecified primary II ▸ Prespecified secondary I ▸ Prespecified secondary II

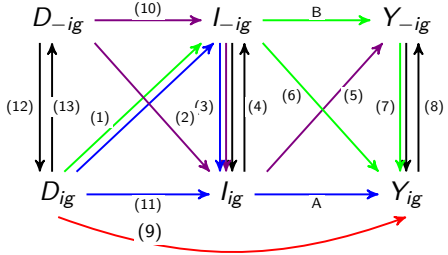
Long-run effects of catastrophic drought insurance on education

	Of households members who were school-aged during the experiment			Share of children in the household		
	Maximum years of education	Total years of education	Average years of education	Working full-time	Working part-time	Studying full-time
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased	2.851*	7.191**	2.471*	-0.367	-0.216	0.423*
	(1.524)	(3.658)	(1.269)	(0.275)	(0.234)	(0.251)
	[0.077]	[0.077]	[0.077]			
Controls	✓	✓	✓	✓	✓	✓
Control mean	7.255	13.275	5.296	0.345	0.208	0.159
Unit of observation	Household	Household	Household	Household	Household	Household
Observations	742	742	742	376	376	376

▸ Education - gender
▸ All seasons IV
▸ Prespecified primary I ▸ Prespecified primary II ▸ Prespecified secondary I ▸ Prespecified secondary II

Robustness to Interpersonal Spillovers

- Individual-level randomization: SUTVA violation?
  - Random variation inintensity of encouragement received by a respondent's peers.
  - Community fixed effects cannot be included (Fruehwirth, Iyer, and Zhang, 2019; Rahman, 2023).
  - Can't distinguish mechanical correlation v spillovers (Guryan, Kroft, and Notowidigdo, 2009; Caeyers and Fafchamps, 2020).



- Potential spillover pathways in the **first- and second-stage** are presented in the DAG.
- We leverage exogenous variation in D_{ig} and D_{-ig} to identify first-stage spillovers.
  - First-stage and second-stage estimates are robust to controlling for discount coupons and insurance purchase by peers ▸ first stage ◂ education ◂ herd composition

Mechanisms

- We investigate dynamics of the effects by re-estimating the same estimating equation on the outcomes observed after 1.5 years (3 sales seasons) and 3 years (6 sales seasons).
  - Effects on herd composition appear immediately, significant after 3 years.
    ▸ Dynamics - herd composition
  - Effects on educational attainment are only observed at the 10-year follow-up
- Results are driven by *ex ante* coverage and induced behavioural change, not ex post indemnity payments ▸ Payout effects - herd composition ▸ Payout effects - education

Suggested interpretation

Catastrophic drought insurance reduced *ex ante* risk exposure and thereby...

1. ...reduced the need for **precautionary savings on the hoof** to cover drought-related expenditures.
   - Reduced the incentive to hold goats for liquidity purposes
2. ...induced hhds to **re-balance livestock portfolio** towards higher-value, lumpier large animals.
   - Yielded higher income through increased productivity of larger animals.

Children (esp. boys) routinely manage goats, while camels/cattle are managed by adult men.

- Changes in production strategies **decreases the marginal productivity of child labor**, which, together with income effects, boosts investments in education
- Increase in education is driven by male children Education effect - gender child

Conclusions

- 10 years after its inception, IBLI had a significant effect on pastoralists'
  - Production strategies: Livestock composition shifted from goats to large ruminants
  - Human capital accumulation: education outcomes grew sharply
- Had no effect on herd size, w/ large, imprecisely estimated impact on total income
- Effects entirely arise from ex ante behavioral responses.
- Insurance can mitigate long-run effects of catastrophic droughts on human capital accumulation
- needs complementary intervention(s) to help boost incomes/wealth of persistently poor pastoralist populations.

Thank you for your interest, time, and comments!

Comments or edits welcome at cbb2@cornell.edu

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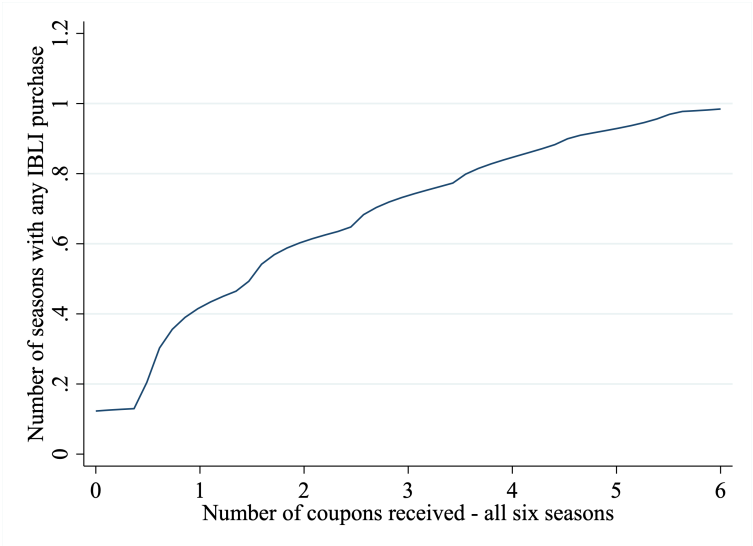
Correlations between discount coupons and insurance uptake



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Summary statistics Ethiopia and Kenya

Baseline controls

	Kenya		Ethiopia	
	Mean	[SD]	Mean	[SD]
Age of the household head	48.08	[18.35]	50.23	[18.30]
Male headed household (=1)	0.63	[0.48]	0.79	[0.41]
Household head's years of education	1.05	[3.07]	0.54	[1.84]
Adult equivalent	4.68	[1.95]	4.94	[2.01]
Dependency ratio	0.50	[0.21]	0.54	[0.19]
Herd size (CMVE)	25.48	[35.98]	17.01	[23.90]
Annual income per AE (USD)	121.45	[198.01]	102.79	[159.19]
Own or farm agricultural land	0.18	[0.38]	0.65	[0.48]
Fully settled (=1)	0.23	[0.42]	0.76	[0.43]
Observations	781		398	

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Summary statistics Ethiopia and Kenya

Baseline outcomes

Primary outcomes

	Kenya		Ethiopia	
	Mean/SD	Obs	Mean/SD	Obs
Baseline prespecified primary outcomes				
Share of camels in herd (CMVE)	0.30	[0.31]	0.12	[0.21]
Share of cattle in herd (CMVE)	0.30	[0.36]	0.67	[0.25]
Share of goats in herd (CMVE)	0.25	[0.26]	0.17	[0.18]
Share of sheep in herd (CMVE)	0.14	[0.17]	0.05	[0.08]
Annual total household cash earning (USD)	516.55	[828.25]	462.92	[594.14]
Maximum years of education	3.54	[3.30]	2.92	[2.55]
Observations	781		398	

Secondary outcomes

	Kenya		Ethiopia	
	Mean/SD	Obs	Mean/SD	Obs
Baseline prespecified secondary outcomes				
Herd management expenditure (USD)	48.79	[153.93]	41.00	[129.63]
Annual milk income (USD)	886.04	[1668.25]	161.81	[265.31]
Livestock lost in the past 12 months (CMVE)	11.05	[15.22]	9.20	[16.96]
N of lost camel	1.15	[3.56]	0.28	[0.81]
N of lost cattle	5.13	[11.40]	7.58	[16.04]
N of lost goats/sheep	32.52	[55.13]	5.69	[8.67]
Distress sale in the past 12 months (CMVE)	0.77	[2.03]	7.72	[19.66]
Share of children working full-time	0.36	[0.38]	0.47	[0.34]
Share of children working part-time	0.29	[0.39]	0.26	[0.32]
Share of children studying full-time	0.22	[0.36]	0.12	[0.23]
Observations	781		398	

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Balance of coupon distribution

	Received coupon vs. No coupon						
Sales Season Kenya: Sales Season Ethiopia:	2010 JF 2012 AS	2011 JF 2013 JF	2011 AS 2013 AS	2012 AS 2014 JF	2013 JF 2014 AS	2013 AS 2015 JF	F-test
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age of the household head	0.493	1.37	-0.243	0.0224	1.28	0.0177	3.94
	(1.05)	(1.04)	(1.01)	(0.959)	(0.944)	(1.09)	{0.685}
	[0.0515]	[0.0862]	[0.0173]	[0.0309]	[0.101]	[0.00159]	
Male headed household (=1)	-0.0206	-0.0265	-0.0340	-0.0373	0.00494	-0.0253	7.14
	(0.0248)	(0.0244)	(0.0243)	(0.0245)	(0.0251)	(0.0284)	{0.308}
	[0.0345]	[0.0235]	[0.00977]	[-0.00182]	[0.0790]	[-0.0608]	
Education of household head	-0.238	-0.0563	-0.0407	0.0914	-0.224	0.183	5.99
	(0.171)	(0.170)	(0.163)	(0.155)	(0.158)	(0.157)	{0.424}
	[-0.121]	[-0.0606]	[-0.0805]	[-0.0370]	[-0.153]	[0.0777]	
Adult equivalent	-0.00907	0.0569	-0.108	-0.0176	-0.137	-0.142	3.43
	(0.120)	(0.118)	(0.119)	(0.116)	(0.119)	(0.147)	{0.753}
	[0.0308]	[0.0414]	[-0.00252]	[0.0267]	[-0.0253]	[-0.0707]	
Dependency ratio	-0.00238	-0.00368	0.00527	0.0125	0.0148	-0.0123	4.59
	(0.0118)	(0.0114)	(0.0113)	(0.0110)	(0.0109)	(0.0123)	{0.597}
	[0.0446]	[0.0462]	[0.0940]	[0.129]	[0.138]	[-0.0634]	
Herd size (CMVE)	1.14	-0.917	-0.252	-1.36	0.453	-2.06	3.17
	(1.63)	(1.61)	(1.69)	(1.44)	(1.15)	(1.87)	{0.787}
	[-0.0200]	[-0.0637]	[-0.0410]	[-0.0261]	[0.0794]	[-0.0876]	
Annual income per AE (USD)	-4.77	-15.8	-3.28	11.1	-2.64	-20.0	4.03
	(10.2)	(15.5)	(13.7)	(10.6)	(12.8)	(16.4)	{0.673}
	[-0.0438]	[-0.113]	[-0.0875]	[0.0173]	[-0.0829]	[-0.0816]	
Own or farm agricultural land	-0.0293*	-0.00378	0.0151	0.0221	-0.0169	-0.00445	6.95
	(0.0174)	(0.0170)	(0.0157)	(0.0166)	(0.0159)	(0.0190)	{0.326}
	[0.152]	[0.204]	[0.290]	[0.259]	[0.180]	[-0.00469]	
F statistics of Joint F-test:	5.988	4.702	4.279	8.845	8.241	8.770	
P-value of Joint F-test:	0.649	0.789	0.831	0.356	0.410	0.362	

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Differential attrition across cumulative coupon receipt status

	Outcome: Interviewed at baseline but not in latest round (=1)	
	(1)	(2)
N of coupons received – the initial three seasons	-.00764	
	(.00998)	
N of coupons received – all six seasons		-.00285
		(.00734)
N	1439	1439

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Selective attrition across baseline characteristics

	Outcome: Interviewed at baseline but not in latest round (=1)
	(1)
Age of the household head	-2.04
	(1.33)
Male headed household (=1)	-.0555*
	(.0335)
Education of household head	.355
	(.229)
Adult equivalent	-.383***
	(.143)
Dependency ratio	-.00781
	(.0151)
Herd size (CMVE)	1.3
	(1.95)
Annual income per AE (USD)	20.8
	(15.9)
Own or farm agricultural land	-.0478*
	(.0254)
P-value of joint F-test	0.016
N	1439

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Checking monotonicity assumption

	Number of seasons purchase IBLI			
Number of coupons recipient's received	0	1	2	3
0	80.00	16.25	3.75	0
1	67.8	27.12	4.80	0.28
2	51.65	38.82	9.19	0.35
3	48.21	34.52	17.26	0

	Any insurance purchase – first three seasons	
Number of coupons recipient's received	0	1
0	80	20
1	67.8	32.2
2	51.65	48.35
3	48.21	51.79

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Checking monotonicity assumption

	Number of seasons purchase IBLI			
Number of coupons recipient's received	0	1	2	3
0	80.00	16.25	3.75	0
1	67.8	27.12	4.80	0.28
2	51.65	38.82	9.19	0.35
3	48.21	34.52	17.26	0

	Any insurance purchase – first three seasons	
Number of coupons recipient's received	0	1
0	80	20
1	67.8	32.2
2	51.65	48.35
3	48.21	51.79

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First stage using all six sales seasons

	Any insurance purchased – all six seasons						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No. of coupons received – all six seasons	0.060***						
	(0.010)						
Received coupon – first season		0.136***					
		(0.030)					
Received coupon – second season			0.095***				
			(0.030)				
Received coupon – third season				0.041			
				(0.029)			
Received coupon – fourth season					0.005		
					(0.030)		
Received coupon – fifth season						0.014	
						(0.030)	
Received coupon – sixth season							-0.004
							(0.035)
Controls	✓	✓	✓	✓	✓	✓	✓
Effective F-stat	32.774	21.029	9.860	1.982	0.024	0.223	0.016
10% Critical Value	23.109	23.109	23.109	23.109	23.109	23.109	23.109
N	1179	1166	1154	1165	1154	1151	1151

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Number of animals by species

	N of animals (CMVE)				Raw N of animals			
	Camel	Cattle	Goat	Sheep	Camel	Cattle	Goat	Sheep
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased	1.453	-1.106	-0.398	-0.276	0.858	-1.106	-5.852	-3.497
	(4.449)	(4.882)	(0.973)	(0.589)	(2.726)	(4.882)	(8.074)	(5.246)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	9.290	8.037	3.264	2.543	5.638	8.037	21.512	16.850
Observations	1179	1179	1179	1179	1179	1179	1179	1179

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Number of animals by species, by baseline TLU quantile

	N of animals (CMVE)				Raw N of animals			
	Camel	Cattle	Goat	Sheep	Camel	Cattle	Goat	Sheep
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Low or middle baseline TLU class								
Any insurance purchased	-4.946	-4.945	-1.807*	-1.184*	-3.219	-4.945	-17.645*	-10.926
	(4.683)	(4.381)	(0.992)	(0.703)	(2.883)	(4.381)	(9.068)	(6.664)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	5.729	6.136	2.346	2.117	3.542	6.136	15.424	14.000
Observations	790	790	790	790	790	790	790	790
Panel B: High baseline TLU class								
Any insurance purchased	8.855	5.233	2.635	1.744	5.349	5.233	17.392	12.800
	(9.522)	(11.452)	(2.623)	(1.343)	(5.777)	(11.452)	(19.123)	(10.183)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	19.295	13.381	5.845	3.740	11.524	13.381	38.619	24.857
Observations	389	389	389	389	389	389	389	389

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Effects on income

	Aggregate	Mutually exclusive categories (USD)								
	Total income	In-kind milk income	Milk earnings	In-kind slaughter income	Slaughter earnings	Animal birth income	In-kind crop income	Crop earnings	Employment income	Other earnings
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Any insurance purchased	337.145	286.553	39.427	-21.092	47.990	-42.939	48.478***	5.408	-10.437	-38.979
	(513.819)	(308.339)	(155.529)	(37.017)	(35.363)	(99.106)	(16.964)	(29.400)	(8.712)	(205.333)
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[0.061]	[1.000]	[1.000]	[1.000]
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	1292.971	110.007	345.689	63.310	20.065	173.375	3.733	8.350	5.781	562.661
Observations	1179	1179	1179	1179	1179	1179	1179	1179	1179	1179

Back

Effects on aggregated income – total livestock and crop

	Annual income (USD)		$= 1$ if the outcome > 0	
	Total livestock income	Total crop income	Annual total livestock income	Annual total crop income
	(1)	(2)	(3)	(4)
Any insurance purchased	324.834	54.707	0.039	0.087
	(442.301)	(34.507)	(0.108)	(0.086)
Controls	✓	✓	✓	✓
Control mean	712.447	12.083	0.787	0.138
Observations	1179	1179	1179	1179

Back

Robustness: Using IBLI uptake and coupon receipts from all six sales seasons

	Outcome: N of animal type in CMVE / Total N of animals in CMVE					
	Camel	Cattle	Goats	Sheep	Camels & cattle	Goats & sheep
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased (in six sales seasons)	0.135	0.106	-0.257**	0.015	0.242*	-0.242*
	(0.104)	(0.096)	(0.109)	(0.058)	(0.129)	(0.129)
Controls	✓	✓	✓	✓	✓	✓
Control mean	0.000	0.214	0.348	0.438	0.214	0.786
Observations	987	987	987	987	987	987

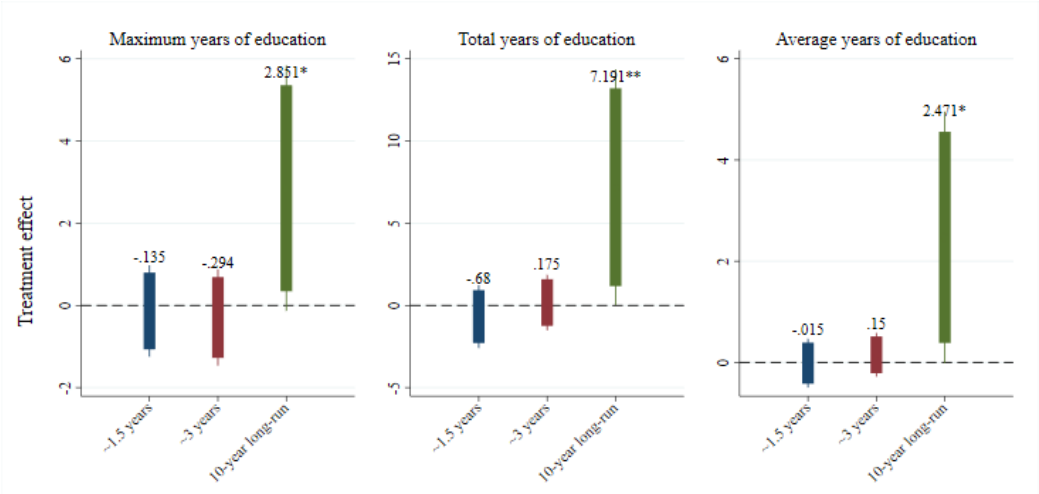
Back

Robustness: Using IBLI uptake and coupon receipts from all six sales seasons

	Of households members who were school-aged during the experiment			Share of children in the household		
	Maximum years of education	Total years of education	Average years of education	Working full-time	Working part-time	Studying full-time
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased (in six sales seasons)	3.018	8.209*	2.541	-0.452	-0.255	0.577
	(1.864)	(4.420)	(1.558)	(0.444)	(0.401)	(0.451)
Controls	✓	✓	✓	✓	✓	✓
Control mean	5.889	8.333	4.833	0.575	0.000	0.000
Unit of observation	Household	Household	Household	Household	Household	Household
Observations	742	742	742	376	376	376

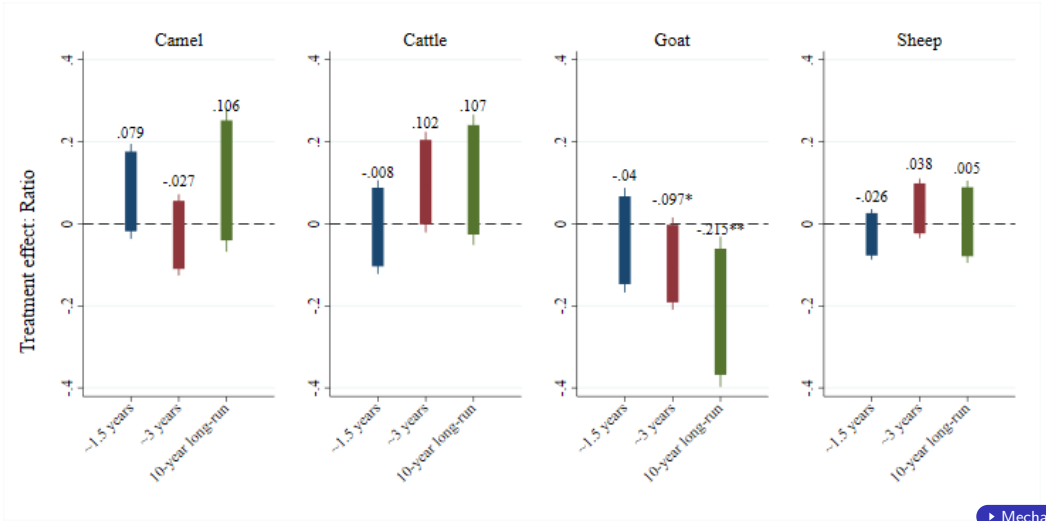
Back

Dynamics: Educational attainment over time



◂ Mechanisms

Dynamics: Herd composition over time



▸ Mechanisms

Prespecified primary outcomes I

	Herd size (CMVE)		Annual household cash earnings (USD)		Maximum years of education	
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased	2.078	3.293	-6.640	17.509	2.905*	2.851*
	(8.731)	(8.879)	(208.960)	(209.538)	(1.522)	(1.524)
Controls		✓		✓		✓
Control mean	14.979	14.979	591.076	591.076	7.255	7.255
Observations	1179	1179	1179	1179	742	742

Back

Prespecified primary outcomes II

	Outcome: N of animal type in CMVE / Total N of animals in CMVE			
	Camel	Cattle	Goats	Sheep
	(1)	(2)	(3)	(4)
Any insurance purchased	0.106	0.107	-0.215**	0.005
	(0.089)	(0.081)	(0.094)	(0.051)
Controls	✓	✓	✓	✓
Control mean	0.255	0.311	0.293	0.141
Observations	987	987	987	987

Back

Prespecified secondary outcomes I

	Herd management expenditure (USD)		Milk Income (USD)		Livestock loss (CMVE)		Distress sales (CMVE)		Livestock Sale (CMVE)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Any insurance purchased	2.611	-6.138	311.749	334.347	1.813	1.050	-0.331	-0.420	-1.144	-1.115
	(89.456)	(91.898)	(392.579)	(397.344)	(2.893)	(2.699)	(0.529)	(0.517)	(1.457)	(1.455)
Controls		✓		✓		✓		✓		✓
Control mean	207.775	207.775	455.696	455.696	5.503	5.503	0.381	0.381	2.595	2.595
Observations	1179	1179	1179	1179	1179	1179	781	781	1179	1179

Back

Prespecified secondary outcomes II

	IBLI uptake in the past 12 months (=1 if purchased)		IBLI uptake in the past 12 months (CMVE)		Working full-time		Working part-time		Studying full-time	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Any insurance purchased	0.033	0.037	-0.974	-0.940	-0.302	-0.367	-0.224	-0.216	0.436*	0.423*
	(0.043)	(0.044)	(0.896)	(0.911)	(0.273)	(0.275)	(0.243)	(0.234)	(0.264)	(0.251)
Controls		✓		✓		✓		✓		✓
Control mean	0.037	0.037	0.308	0.308	0.345	0.345	0.208	0.208	0.159	0.159
Observations	1179	1179	1179	1179	376	376	376	376	376	376

Back

Education - Male child vs. Female child

	Male			Female		
	Maximum years of education	Total years of education	Average years of education	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased	3.697**	7.113**	3.250**	2.107	3.342	2.646
	(1.737)	(3.386)	(1.420)	(1.724)	(3.214)	(1.743)
Controls	✓	✓	✓	✓	✓	✓
Control mean	6.575	9.261	4.883	6.306	8.194	5.530
Observations	478	499	499	346	346	346

Back

Education - Male child vs. Female child

	Male			Female		
	Maximum years of education	Total years of education	Average years of education	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased	3.697**	7.113**	3.250**	2.107	3.342	2.646
	(1.737)	(3.386)	(1.420)	(1.724)	(3.214)	(1.743)
Controls	✓	✓	✓	✓	✓	✓
Control mean	6.575	9.261	4.883	6.306	8.194	5.530
Observations	478	499	499	346	346	346

Back

Payout effect: Herd composition

	Outcome: N of animal type in CMVE / Total N of animals in CMVE							
	Camel		Cattle		Goats		Sheep	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased (γ_1)	0.0218	-0.0181	0.219**	0.217**	-0.268**	-0.227*	0.0108	0.0249
	(0.119)	(0.114)	(0.103)	(0.0989)	(0.128)	(0.121)	(0.0673)	(0.0646)
Any insurance purchased × Indemnity rate (γ_2)	0.187	0.683	-1.893	-1.982	1.534	1.224	0.134	0.0210
	(0.786)	(0.799)	(1.250)	(1.224)	(1.132)	(1.108)	(0.399)	(0.443)
Coef: $\gamma_1 + \gamma_2$	0.209	0.665	-1.674	-1.765	1.266	0.996	0.145	0.046
p-val.: $\gamma_1 + \gamma_2$	0.848	0.371	0.098	0.143	0.129	0.351	0.783	0.910
Controls		✓		✓		✓		✓
Control mean	0.255	0.255	0.311	0.311	0.293	0.293	0.141	0.141
Observations	595	595	595	595	595	595	595	595

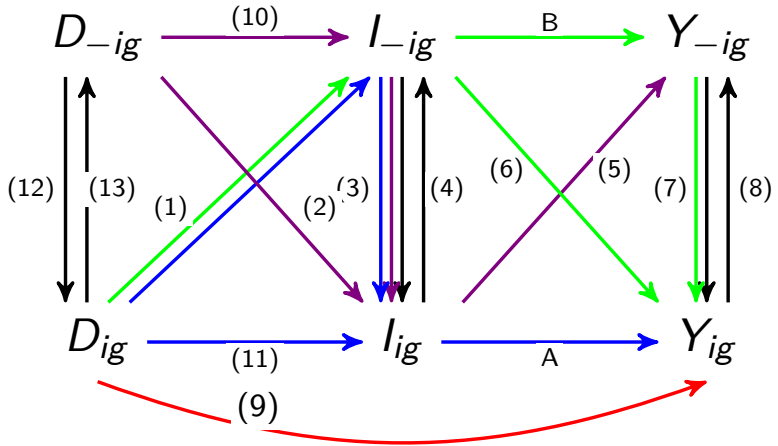
Back

Payout effect: Education

	Of household members who were school-aged during the experiment					
	Maximum years of education		Total years of education		Average years of education	
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased (γ_1)	3.122**	3.109**	7.417*	7.763**	2.455*	2.625**
	(1.581)	(1.586)	(3.849)	(3.842)	(1.335)	(1.318)
Any insurance purchased × Indemnity rate (γ_2)	-19.06	-21.29*	-39.21	-49.03	-11.27	-12.57
	(13.80)	(12.88)	(38.98)	(38.59)	(13.83)	(11.94)
Coef: $\gamma_1 + \gamma_2$	-15.937	-18.178	-31.797	-41.268	-8.811	-9.946
p-val.: $\gamma_1 + \gamma_2$	0.125	0.142	0.252	0.268	0.338	0.389
Controls		✓		✓		✓
Control mean	7.255	7.255	13.275	13.275	5.296	5.296
Unit of observation	Household	Household	Household	Household	Household	Household
Observations	742	742	742	742	742	742

◂ Back

Potential spillover interactions



Back

Robustness Check: Social spillovers and mechanical correlations

	Outcome: Number of coupons received - first three seasons		Outcome: Any insurance purchase - first three seasons					
	D_{ij}: Recipient's	$\overline{D}_{-ij}$: Peers'	I_{ij}: Recipient's			$\overline{I}_{-ij}$: Peers'		
No. of coupons received – first three seasons	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D_{ij}: Recipient's		-0.005	0.117***		0.116***	-0.007		-0.008
		(0.004)	(0.017)		(0.017)	(0.006)		(0.006)
$\overline{D}_{-ij}$: Peers'	-0.225			-0.311**	-0.285**		-0.182***	-0.184***
	(0.179)			(0.124)	(0.123)		(0.040)	(0.040)
Pathway (DAG)	(12)	(13)	(11)	(2)	(2);(11)	(1)	(10)	(1);(10)
Recipient controls (i)								
Peers' controls (-i)								
community FE								
Control mean	1.707	1.707	0.200	.	0.200	0.426	.	0.426
Observations	1179	1179	1179	1179	1179	1179	1179	1179

Back

Spillover effects on education outcomes

	Of households members who were school-aged during the experiment			Share of children in the household		
	Maximum years of education	Total years of education	Average years of education	Working full-time	Working part-time	Studying full-time
	(1)	(2)	(3)	(4)	(5)	(6)
$\hat{I}_{ij}$: Any insurance purchase - first three seasons	2.337	5.823	1.850	-0.382	-0.132	0.408
	(1.511)	(3.561)	(1.259)	(0.294)	(0.259)	(0.252)
$\hat{\hat{I}}_{-ij}$: Peers' any insurance purchase – first three season	-14.373***	-34.379***	-10.752***	-0.643	1.362*	-0.552
	(4.258)	(8.722)	(3.263)	(0.932)	(0.704)	(0.724)
Recipient controls (i)						
Peer's controls (-i)	✓	✓	✓	✓	✓	✓
Control mean	7.255	13.275	5.296	0.345	0.208	0.159
Village FE						
Unit of observation	Household	Household	Household	Household	Household	Household
Observations	742	742	742	376	376	376

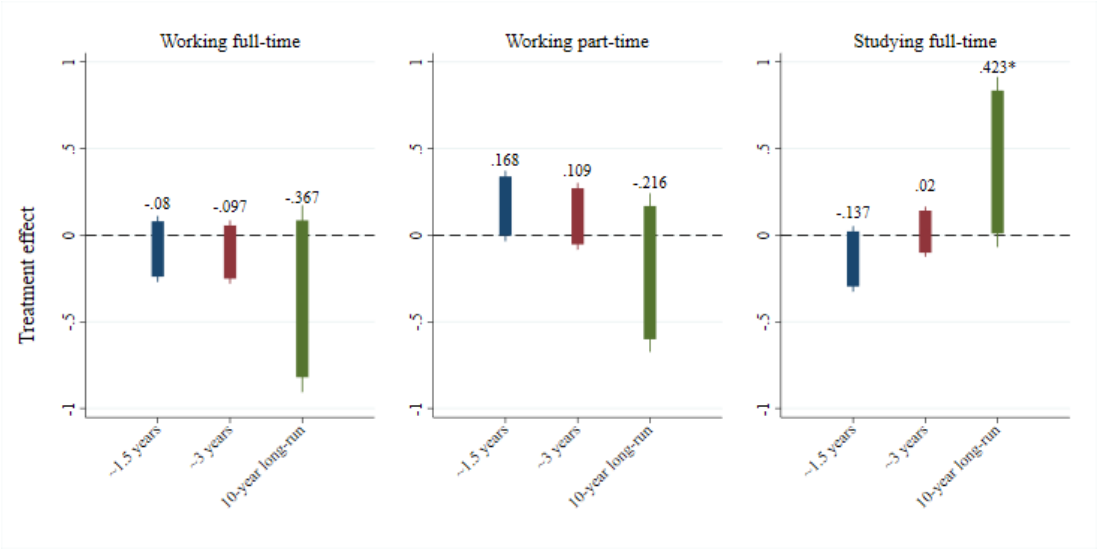
Back

Spillover effects on herd composition

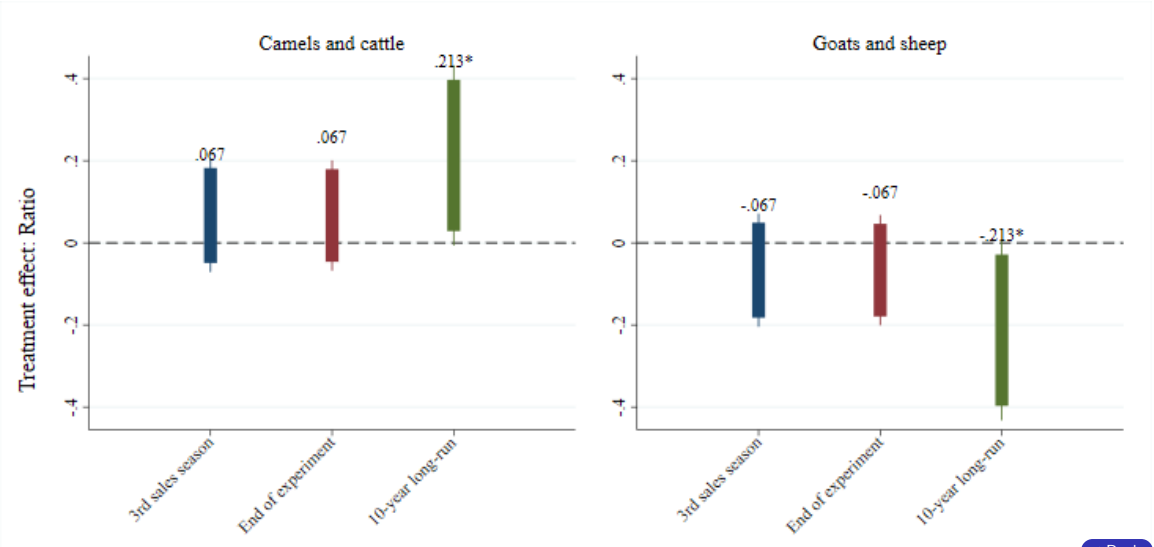
	Outcome: N of animal type in CMVE / Total N of animals in CMVE					
	Camel	Cattle	Goats	Sheep	Camels & cattle	Goats & sheep
	(1)	(2)	(3)	(4)	(5)	(6)
$\hat{I}_{ij}$: Any insurance purchase - first three seasons	0.131	0.113	-0.231**	-0.007	0.240**	-0.240**
	(0.093)	(0.085)	(0.098)	(0.052)	(0.116)	(0.116)
$\hat{\bar{I}}_{-ij}$: Peers' any insurance purchase – first three season	-0.328	0.348*	-0.002	-0.130	0.067	-0.067
	(0.209)	(0.209)	(0.247)	(0.129)	(0.283)	(0.283)
Recipient controls (i)						
Peers' controls (-i)	✓	✓	✓	✓	✓	✓
Control mean	0.255	0.311	0.293	0.141	0.566	0.434
Village FE						
Observations	987	987	987	987	987	987

◂ Back

Dynamics: Children's work and schooling over time



Effects on the share of large vs small animal types over time



Back

Payout effect: Education outcomes

	Of household members who were school-aged during the experiment					
	Maximum years of education		Total years of education		Average years of education	
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased (γ_1)	3.897**	3.543**	8.890**	8.558**	2.736*	2.759**
	(1.728)	(1.688)	(4.212)	(4.102)	(1.436)	(1.381)
Any insurance purchased × Indemnity rate (γ_2)	-11.91	-5.581	24.92	36.16	-1.190	-0.293
	(13.89)	(11.84)	(50.74)	(47.29)	(12.80)	(10.58)
Coef: $\gamma_1 + \gamma_2$	-8.011	-2.038	33.808	44.723	1.546	2.466
p-val.: $\gamma_1 + \gamma_2$	0.296	0.850	0.762	0.326	0.774	0.801
Controls		✓		✓		✓
Control mean	7.255	7.255	13.275	13.275	5.296	5.296
Unit of observation	Household	Household	Household	Household	Household	Household
Observations	742	742	742	742	742	742

$$y_{ijT} = \gamma_0 + \gamma_1 \widehat{I_{ij}} + \gamma_2 \widehat{I_{ij}} \times R_{jt} + \gamma_3 y_{ij0} + \gamma_4 X_{ij0} + \gamma_5 D^T_{ij4} + \rho_j + \varepsilon_{ijT} \quad (3)$$

Payout effect: Herd composition

	Outcome: N of animal type in CMVE / Total N of animals in CMVE							
	Camel		Cattle		Goats		Sheep	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased (γ_1)	0.195*	0.101	0.000737	0.0646	-0.155	-0.155	0.0266	0.0239
	(0.115)	(0.103)	(0.102)	(0.0927)	(0.112)	(0.103)	(0.0604)	(0.0558)
Any insurance purchased × Indemnity rate (γ_2)	-1.242	-0.329	0.0532	-1.040	1.509	1.644	-0.611	-0.331
	(0.857)	(0.836)	(1.177)	(1.166)	(1.184)	(1.186)	(0.421)	(0.415)
Coef: $\gamma_1 + \gamma_2$	-1.047	-0.229	0.054	-0.975	1.354	1.489	-0.584	-0.307
p-val.: $\gamma_1 + \gamma_2$	0.128	0.768	0.966	0.389	0.182	0.193	0.177	0.412
Controls		✓		✓		✓		✓
Control mean	0.255	0.255	0.311	0.311	0.293	0.293	0.141	0.141
Observations	987	987	987	987	987	987	987	987