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, including precautionary savings in kind, with child labor implications (Shah and Steinberg 2017)
    - 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).

- Insurance market failures are an important reason why catastrophic risk has adverse impacts (Lybbert et al., 2004; Karlan et al., 2014; Barrett et al., 2019).

- ...but evidence on the long-run impacts of insurance is lacking.

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 over time, and whether effects are generated by *ex ante* coverage or *ex post* payouts.

What we find

▸ Contribution

Long-run impacts of IBLI

- Herd composition changes: a 48% reduction in smaller animals (goats to large stock)
  - Heterogeneity: households with small baseline herds reduced smaller livestock ($\sim$26 goats).
- Substantial increase (40%-55% over control group) in the maximum, total, and average education of household members who were school-aged during the experiment.

Mechanisms

- **No effect on recent IBLI uptake** of initial adoption ... supply-side problems.
- Impacts from *ex ante* **behavioral effects**, not to *ex post* indemnity payments.
- Herd size effects materialized promptly. Educational effects observed only at endline.
- Reduced risk exposure induced less precautionary savings in kind (as goats), reducing marginal productivity of child labor, leading to greater schooling.

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In the long-run, with IBLI...

From herding goats ...

... to school!

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Setting: Northern Kenya (Marsabit) and Southern Ethiopia (Borena)
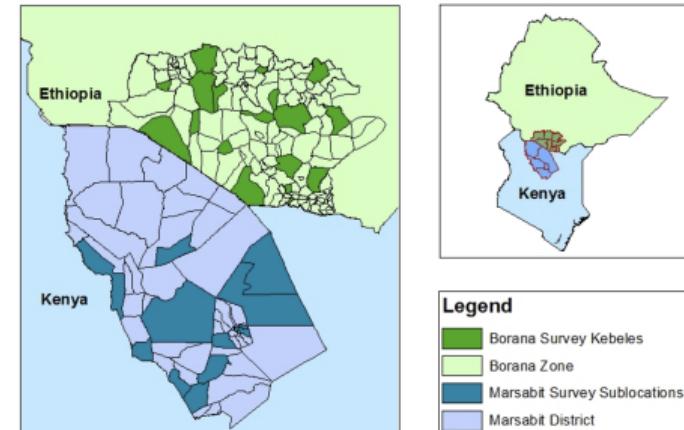
▸ Summary statistics

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.

Legend
Borana Survey Kebeles
Borana Zone
Marsabit Survey Sublocations
Marsabit District

Intervention: Index-Based Livestock Insurance (IBLI)

Product

- Unlike most agricultural index insurance, IBLI insures against the loss of durable **assets**: livestock, the main non-human asset and source of livelihood for pastoralists.

- Index uses satellite-based Normalized Difference Vegetation Index (NDVI) indicator of forage scarcity, specifically designed to minimize basis risk (Chantarat et al. 2013)..

- 1st piloted in 2010 in northern Kenya. Expanded into southern Ethiopia in 2012. Foundation of Kenya Livestock Insurance Program (began 2015). Now used in Ethiopia, Kenya, Mauritania, Zambia (>560K insured)

- Recent (DRIVE) initiative by WB and gov'ts of Kenya, Ethiopia, Djibouti and Somalia aims to scale IBLI to reach 1.6 million pastoralists by 2025

- From 2009-2015, low NDVI triggered drought index 4 times in Kenya, 1 time in Ethiopia.

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.

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Estimation strategy: First stage

▶ Distribution of coupon and uptake

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

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

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

▸ IV assumptions   ▸ Attrition analysis

We estimate:

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

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.

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First stage regression results

	Any insurance purchased – first three seasons	Respondent purchased ANY IBLI in each season					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No. of coupons received – first three seasons	0.124*** (0.016)						
Coupon Receipt – first season		0.236*** (0.023)					
Coupon Receipt – second season			0.078*** (0.022)				
Coupon Receipt – third season				0.127*** (0.017)			
Coupon Receipt – fouth season					0.066*** (0.017)		
Coupon Receipt – fifth season						0.070*** (0.016)	
Coupon Receipt – sixth season							0.058*** (0.013)
Controls	✓	✓	✓	✓	✓	✓	✓
Effective F-statistics	57.374	106.329	12.878	55.462	15.587	19.502	19.669
10% Critical Value	23.109	16.380	16.380	16.380	16.380	16.380	16.380
Control mean	0.237	0.117	0.113	0.041	0.057	0.047	0.023
N	1179	1168	1168	1176	1175	1173	1171

Long-run effects of catastrophic drought insurance on herd composition

	Share of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased	0.209*	-0.209*	6.316	-0.865	-2.007	-2.591*	13.827*	1.666
	(0.112)	(0.112)	(4.447)	(1.094)	(5.069)	(1.541)	(7.819)	(1.583)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Sample (Baseline TLUs)	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Control mean	0.566	0.434	9.185	3.617	9.968	3.915	6.986	2.779
Complier mean	0.618	0.382	9.385	2.618	6.497	2.213	15.046	3.412
Observations	987	987	1179	1179	790	790	389	389

Long-run effects of catastrophic drought insurance on education

	Of household members who were school-aged at any point during initial three periods of experiments		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Any insurance purchased	2.906*	7.314**	2.520**
	(1.544)	(3.704)	(1.276)
	[0.074]	[0.074]	[0.074]
Controls	✓	✓	✓
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	742	742	742

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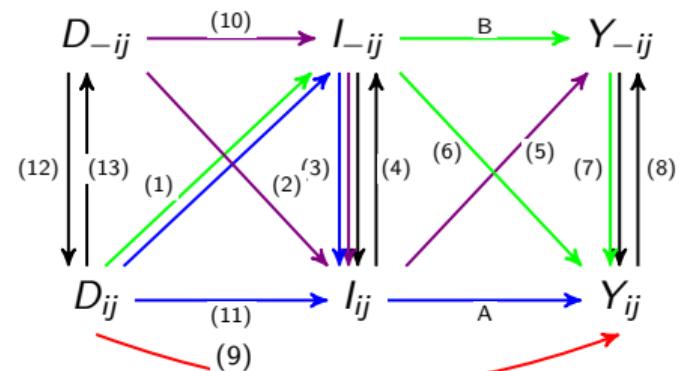
Robustness to Interpersonal Spillovers

- Individual-level randomization: SUTVA violation?
  - Random variation in intensity of encouragement received by a respondent's peers. ▸ summary statistics
  - Community fixed effects cannot be included (Fruehwirth, Iyer, and Zhang, 2019; Rahman, 2023).
  - Can't distinguish mechanical correlation from 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_{ij} and D_{-ij} 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 ◂ herd composition ◂ education ◂ child time use
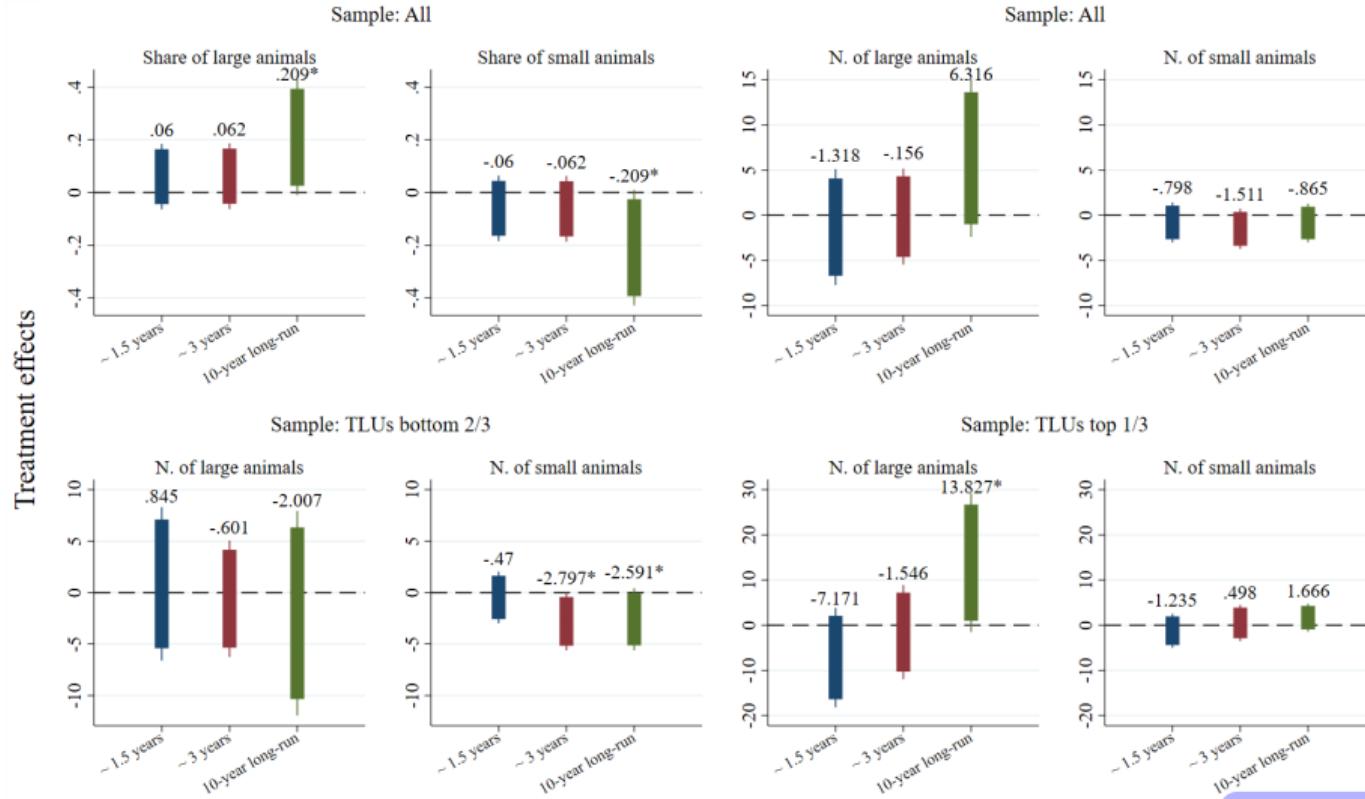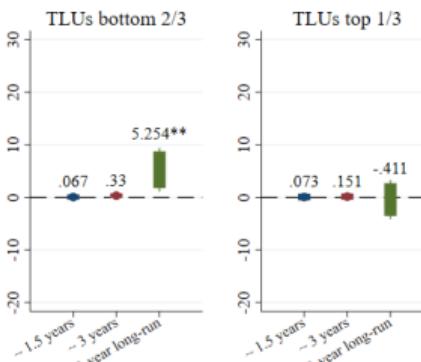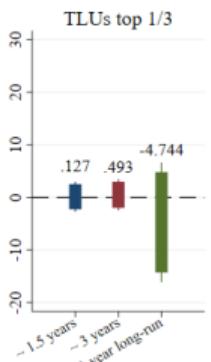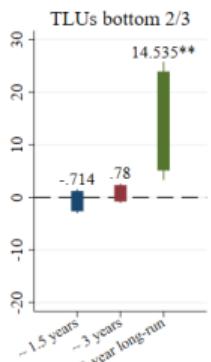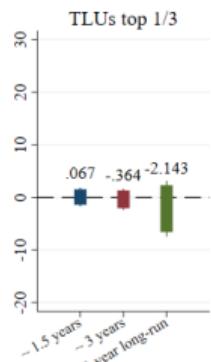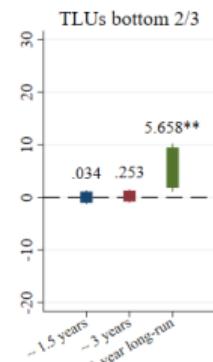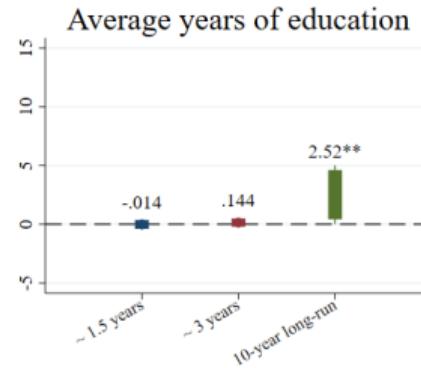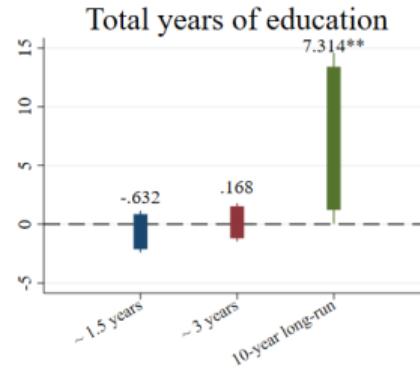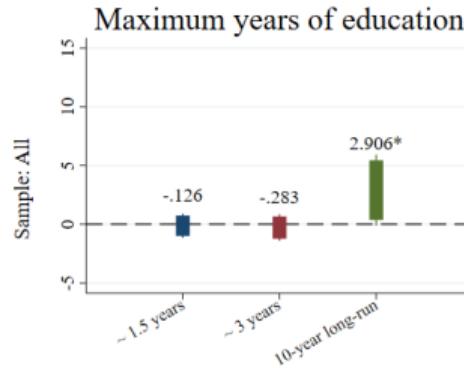
Mechanisms

- 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.
  - 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

- Migration and sedentarization do not explain the results ▸ migration

- Interpretation: insurance reduced *ex ante* risk and precautionary savings (esp. goats), lowering marginal productivity of child labor and boosting education ▸ Interpretation

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Dynamics: Herd composition over time

Dynamics: Educational attainment over time

Conclusions

- 10 years after its inception, IBLI had a significant effect on pastoralists'
  - Production strategies: reduction in the share and number of small livestock herded, particularly for those poorer in the baseline
  - Human capital accumulation: education outcomes grew sharply

- Had no effect on herd size, w/ large, imprecisely estimated impact on total income

- Effects are mainly attributable to *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.

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Contribution to the literature Back
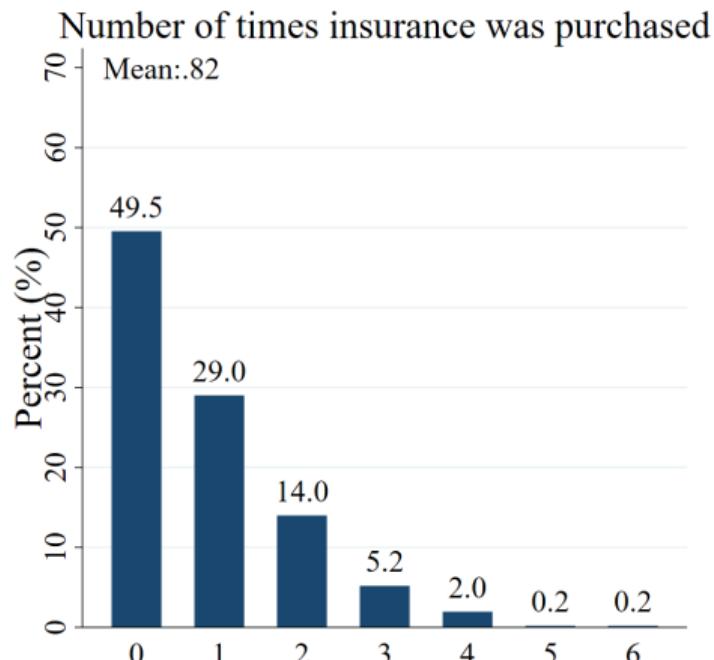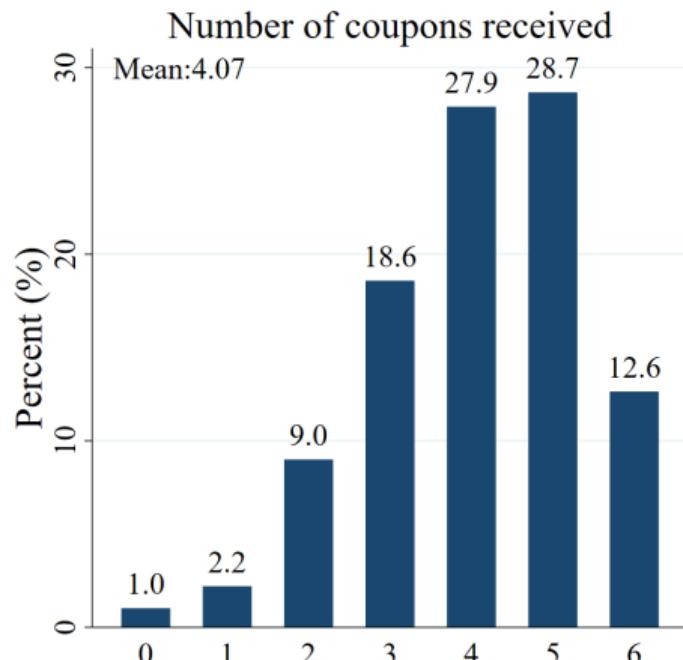
Literature on long-run impacts of covariate weather shocks

- Uninsured exposure to covariate shocks has long-run impacts on height, education, health, and labor market outcome. (e.g., Maccini and Yang, 2009; Shah and Steinberg, 2017; Carrillo, 2020)
- Shocks may change the marginal productivity of labour of children (e.g., Shah and Steinberg, 2017; Bau et al., 2024)
- **Contribution:** Insurance against catastrophic weather shocks affects similar long-run outcomes.
  - Changes in productive strategies change marginal productivity of child labor
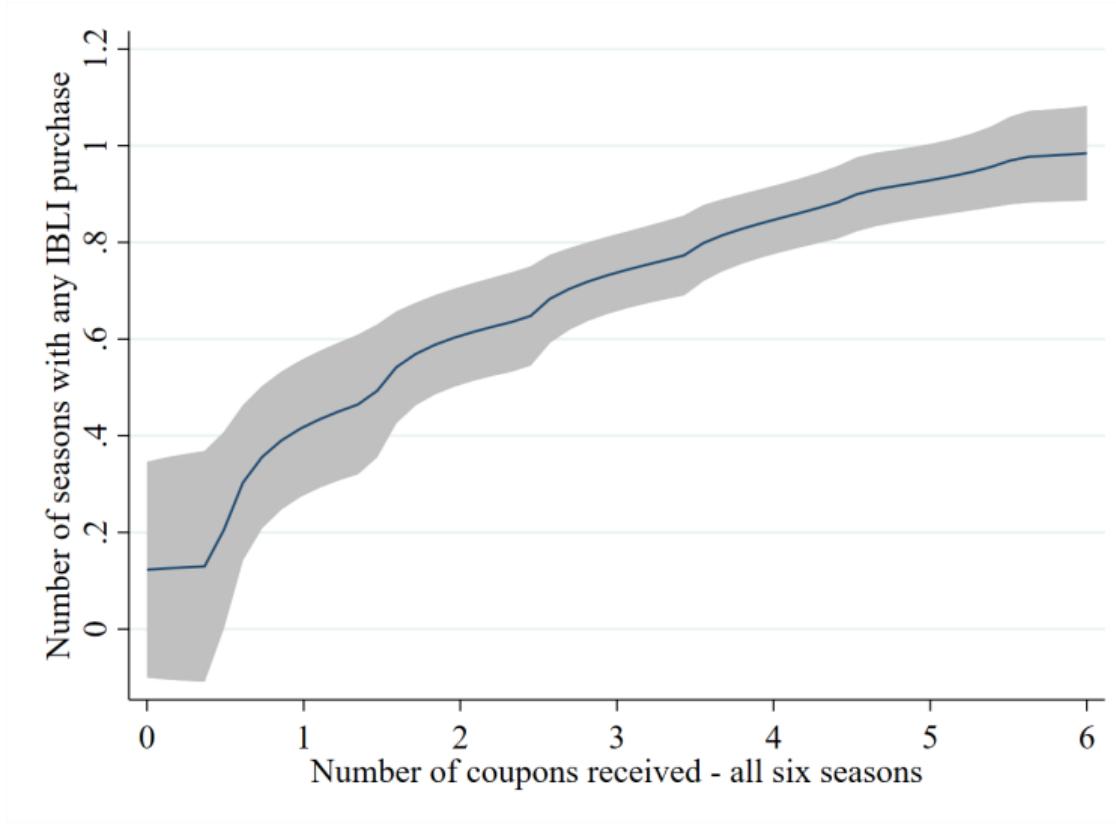
Literature on long-run impacts of development interventions

- Human capital interventions appear effective at boosting long-run economic outcomes (e.g., Hoddinott et al., 2008; Baird et al., 2016; Bettinger et al., 2018; Gray Lobe et al. 2023).
- Cash transfers and grant assistance find short-run effects, particularly on asset accumulation, that fade out in the long-run (Araujo et al., 2017; Baird et al., 2016b; Blattman et al., 2020, 2022)
- **Contribution:** We demonstrate the long-run importance of risk mitigation for human capital formation, which is generated through behavioural change, and not lump-sum transfers.

Discount coupons and insurance uptake

Number of coupons received

Number of times insurance was purchased

Correlations between discount coupons and insurance uptake

Baseline characteristics of pastoral households

	Mean	[SD]
Age of the household head	48.81	[18.35]
Male headed household (=1)	0.68	[0.47]
Household head's years of education	0.87	[2.72]
Adult equivalent	4.77	[1.97]
Dependency ratio	0.51	[0.20]
Herd size (CMVE)	22.62	[32.64]
Annual income per AE (USD)	115.15	[185.95]
Own or farm agricultural land	0.34	[0.47]
Fully settled (=1)	0.41	[0.49]
Observations	1179	

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	

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	

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 inter HH spillovers.

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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 (1.05) [0.0515]	1.37 (1.04) [0.0862]	-0.243 (1.01) [0.0173]	0.0224 (0.959) [0.0309]	1.28 (0.944) [0.101]	0.0177 (1.09) [0.00159]	3.94 {0.685}
Male headed household (=1)	-0.0206 (0.0248) [0.0345]	-0.0265 (0.0244) [0.0235]	-0.0340 (0.0243) [0.00977]	-0.0373 (0.0245) [-0.00182]	0.00494 (0.0251) [0.0790]	-0.0253 (0.0284) [-0.0608]	7.14 {0.308}
Education of household head	-0.238 (0.171) [-0.121]	-0.0563 (0.170) [-0.0606]	-0.0407 (0.163) [-0.0805]	0.0914 (0.155) [-0.0370]	-0.224 (0.158) [-0.153]	0.183 (0.157) [0.0777]	5.99 {0.424}
Adult equivalent	-0.00907 (0.120) [0.0308]	0.0569 (0.118) [0.0414]	-0.108 (0.119) [-0.00252]	-0.0176 (0.116) [0.0267]	-0.137 (0.119) [-0.0253]	-0.142 (0.147) [-0.0707]	3.43 {0.753}
Dependency ratio	-0.00238 (0.0118) [0.0446]	-0.00368 (0.0114) [0.0462]	0.00527 (0.0113) [0.0940]	0.0125 (0.0110) [0.129]	0.0148 (0.0109) [0.138]	-0.0123 (0.0123) [-0.0634]	4.59 {0.597}
Herd size (CMVE)	1.14 (1.63) [-0.0200]	-0.917 (1.61) [-0.0637]	-0.252 (1.69) [-0.0410]	-1.36 (1.44) [-0.0261]	0.453 (1.15) [0.0794]	-2.06 (1.87) [-0.0876]	3.17 {0.787}
Annual income per AE (USD)	-4.77 (10.2) [-0.0438]	-15.8 (15.5) [-0.113]	-3.28 (13.7) [-0.0875]	11.1 (10.6) [0.0173]	-2.64 (12.8) [-0.0829]	-20.0 (16.4) [-0.0816]	4.03 {0.673}
Own or farm agricultural land	-0.0293* (0.0174) [0.152]	-0.00378 (0.0170) [0.204]	0.0151 (0.0157) [0.290]	0.0221 (0.0166) [0.259]	-0.0169 (0.0159) [0.180]	-0.00445 (0.0190) [-0.00469]	6.95 {0.326}
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	

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.

- Overall, households that have fewer adults, or (weakly) female-headed or do not own agricultural land, were more likely to attrit from the sample.

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

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

Checking monotonicity assumption

Number of coupons recipient's received	Number of seasons purchase IBLI			
	0	1	2	3
0	76.250	20.000	3.750	0.000
1	65.819	29.096	4.802	0.282
2	50.953	39.515	9.185	0.347
3	43.452	37.500	19.048	0.000
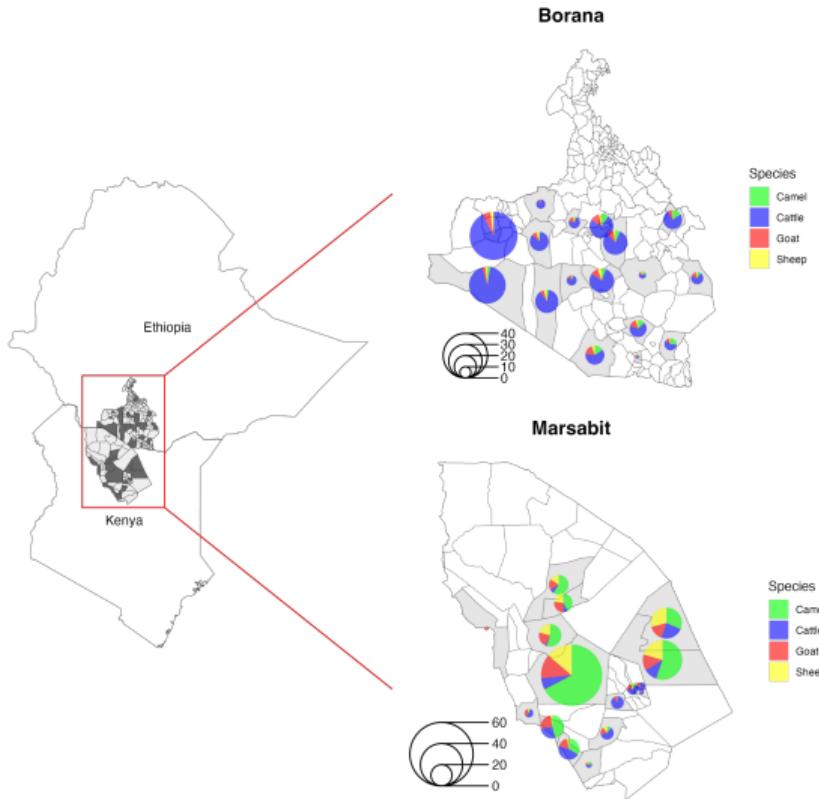
Panel B. Number of coupons recipient's received	Whether or not to purchase IBLI (%)	
	0	1
0	76.250	23.750
1	65.819	34.181
2	50.953	49.047
3	43.452	56.548

Checking monotonicity assumption

Number of coupons recipient's received	Number of seasons purchase IBLI			
	0	1	2	3
0	76.250	20.000	3.750	0.000
1	65.819	29.096	4.802	0.282
2	50.953	39.515	9.185	0.347
3	43.452	37.500	19.048	0.000
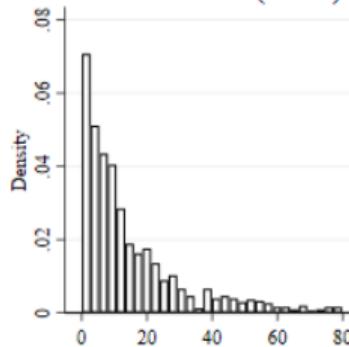
Panel B. Number of coupons recipient's received	Whether or not to purchase IBLI (%)	
	0	1
0	76.250	23.750
1	65.819	34.181
2	50.953	49.047
3	43.452	56.548

Map of study locations and herd (size) distributions per location

Borana

Marsabit

Species
Camel
Cattle
Goat
Sheep
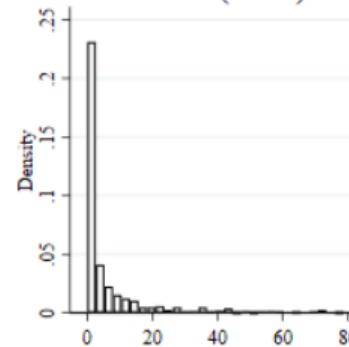
Right-skewed baseline herd distribution (TLU)
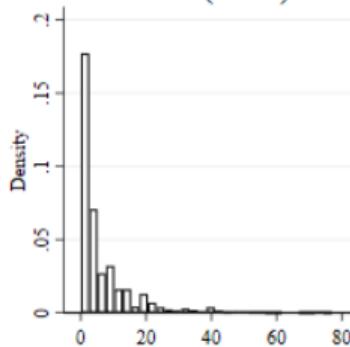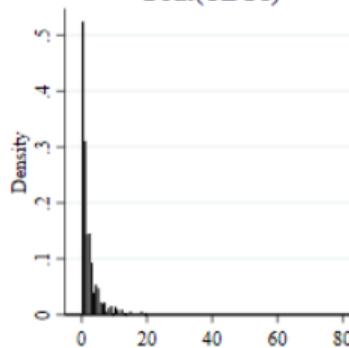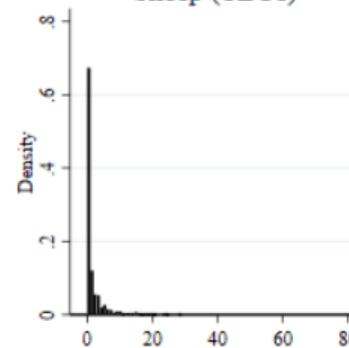
Effects on income

	Aggregate	Mutually exclusive categories (USD)								
	Annual total household income (USD)	Annual in-kind milk income (USD)	Annual earnings from milk (USD)	Annual in-kind slaughter income (USD)	Annual earnings from slaughter (USD)	Annual animal birth income (USD)	Annual in-kind crop income (USD)	Annual earnings income from crop (USD)	Annual employment (food for work) income (USD)	Annual earnings from the rest (USD)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: All samples										
Any insurance purchased	322.285	273.583	37.506	-20.925	47.719	-42.832	48.226***	5.381	-10.384	-38.772
	(510.801)	(306.754)	(154.578)	(36.817)	(35.202)	(98.798)	(16.955)	(29.255)	(8.667)	(204.527)
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]	[0.077]	[1.000]	[1.000]	[1.000]
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	1290.881	110.007	343.598	63.310	20.065	173.375	3.733	8.350	5.781	562.661
Complier mean	1176.312	161.955	267.489	43.557	19.585	141.213	18.207	16.859	2.405	505.042
Observations	1179	1179	1179	1179	1179	1179	1179	1179	1179	1179
Panel B: Low or middle baseline TLU class										
Any insurance purchased	-166.983	25.377	-18.375	-71.851	59.395	-202.937	45.608**	-19.214	-0.230	15.128
	(518.707)	(192.869)	(186.125)	(47.708)	(47.420)	(131.627)	(22.083)	(45.381)	(5.135)	(246.699)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	1228.531	96.149	312.709	76.307	23.370	204.732	5.061	11.322	0.000	498.882
Complier mean	1052.144	145.618	230.785	39.559	15.220	96.588	15.765	17.189	2.903	488.516
Observations	790	790	790	790	790	790	790	790	790	790
Panel C: High baseline TLU class										
Any insurance purchased	1016.430	659.178	22.290	27.808	38.321	208.073	30.707	25.862	-26.825	-6.666
	(973.659)	(718.089)	(258.321)	(53.146)	(56.615)	(177.085)	(21.646)	(16.311)	(19.642)	(296.087)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	1466.054	148.944	430.383	26.796	10.781	85.277	0.000	0.000	22.025	741.848
Complier mean	1419.681	193.974	339.427	51.392	28.141	228.678	22.994	16.212	1.430	537.433
Observations	389	389	389	389	389	389	389	389	389	389

◂ Back

Effects on aggregated income – total livestock and crop

	Annual income (USD)		Extensive margin: = 1 if the outcome > 0	
	Total livestock income	Total crop income	Total livestock income	Total crop income
	(1)	(2)	(3)	(4)
Panel A: All samples				
Any insurance purchased	310.307	54.427	0.039	0.086
	(440.532)	(34.409)	(0.108)	(0.086)
Controls	✓	✓	✓	✓
Control mean	710.356	12.083	0.787	0.138
Complier mean	633.799	35.066	0.801	0.160
Observations	1179	1179	1179	1179
Panel B: Low or middle baseline TLU class				
Any insurance purchased	-207.262	28.724	0.048	-0.015
	(416.869)	(48.662)	(0.151)	(0.121)
Controls	✓	✓	✓	✓
Control mean	713.266	16.383	0.780	0.186
Complier mean	527.771	32.954	0.784	0.169
Observations	790	790	790	790
Panel C: High baseline TLU class				
Any insurance purchased	995.289	50.120	0.031	0.218**
	(911.323)	(32.421)	(0.145)	(0.096)
Controls	✓	✓	✓	✓
Control mean	702.181	0.000	0.810	0.000
Complier mean	841.613	39.206	0.834	0.143
Observations	389	389	389	389

Robustness: Without control variables

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased	0.230**	-0.230**	6.067	-1.028	-1.734	-2.793*	14.173*	1.949
	(0.114)	(0.114)	(4.410)	(1.097)	(5.130)	(1.532)	(7.814)	(1.642)
Controls								
Sample	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Control mean	0.566	0.434	9.185	3.617	9.968	3.915	6.986	2.779
Complier mean	0.618	0.382	9.385	2.618	6.497	2.213	15.046	3.412
Observations	987	987	1179	1179	790	790	389	389

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

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased (in six sales seasons)	0.242*	-0.242*	6.486	-1.318	-0.873	-2.508	15.192	1.394
	(0.129)	(0.129)	(5.099)	(1.288)	(5.115)	(1.592)	(11.105)	(2.253)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Sample	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Control mean	0.214	0.786	0.333	4.127	9.968	3.915	6.986	2.779
Complier mean	0.642	0.358	9.548	2.580	6.880	2.233	14.739	3.255
Observations	987	987	1179	1179	790	790	389	389

Robustness: Effects of IBLI uptake in season 1

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased – season 1	0.197**	-0.197**	4.683	-1.475	1.667	-2.042**	6.692	-0.362
	(0.089)	(0.089)	(3.542)	(0.905)	(3.159)	(0.972)	(8.346)	(1.849)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Sample (Baseline TLUs)	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Control mean	0.542	0.458	8.249	3.013	6.611	2.865	11.576	3.313
Complier mean	0.642	0.358	9.548	2.580	6.880	2.233	14.739	3.255
Observations	976	976	1168	1168	783	783	385	385

Robustness: Effects of IBLI uptake in seasons 1-2

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased – from season 1 to 2	0.290**	-0.290**	9.752*	-0.588	-0.688	-2.395	21.102**	2.760
	(0.136)	(0.136)	(5.381)	(1.312)	(5.774)	(1.697)	(10.740)	(2.148)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Sample (Baseline TLUs)	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Control mean	0.542	0.458	8.249	3.013	6.611	2.865	11.576	3.313
Complier mean	0.642	0.358	9.548	2.580	6.880	2.233	14.739	3.255
Observations	976	976	1168	1168	783	783	385	385

Robustness: Effects of IBLI uptake in seasons 1-4

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased – from season 1 to 4	0.275**	-0.275**	5.438	-1.424	1.495	-2.147	6.124	0.117
	(0.134)	(0.134)	(5.013)	(1.257)	(4.780)	(1.482)	(9.934)	(2.131)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Sample (Baseline TLUs)	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Control mean	0.542	0.458	8.249	3.013	6.611	2.865	11.576	3.313
Complier mean	0.642	0.358	9.548	2.580	6.880	2.233	14.739	3.255
Observations	976	976	1168	1168	783	783	385	385

Robustness: Effects of IBLI uptake in seasons 1-5

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased – from season 1 to 5	0.283**	-0.283**	6.110	-1.788	0.554	-3.018*	8.467	-0.047
	(0.135)	(0.135)	(5.072)	(1.256)	(5.507)	(1.745)	(8.318)	(1.732)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Sample (Baseline TLUs)	All	All	All	All	Botom 2/3	Botom 2/3	Bottom 2/3	Bottom 2/3
Control mean	0.166	0.834	1.900	4.044	2.338	4.900	0.000	0.333
Complier mean	0.642	0.358	9.548	2.580	6.880	2.233	14.739	3.255
Observations	976	976	1168	1168	783	783	385	385

Robustness: Number of IBLI as the endogenous variable

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
N. of IBLI purchased	0.147*	-0.147*	4.435	-0.607	-1.403	-1.812*	10.328*	1.241
	(0.078)	(0.078)	(3.113)	(0.765)	(3.538)	(1.051)	(5.988)	(1.188)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Sample	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Control mean	0.214	0.786	0.333	4.127	9.968	3.915	6.986	2.779
Complier mean	0.618	0.382	9.385	2.618	6.497	2.213	15.046	3.412
Observations	987	987	1179	1179	790	790	389	389

Long-run effects of catastrophic drought insurance on child time use

	Share of children in the household	
	Working	Studying full-time
	(1)	(2)
Any insurance purchased	-0.550	0.423*
	(0.338)	(0.251)
Controls	✓	✓
Control mean	0.553	0.159
Complier mean	0.464	0.221
Observations	376	376

Effects on education by baseline TLU class

	Of household members who were school-aged at any point during initial three periods of experiments		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: Low or middle baseline TLU class			
Any insurance purchased	5.658**	14.535**	5.254**
	(2.337)	(5.723)	(2.124)
Controls	✓	✓	✓
Control mean	6.917	11.528	5.051
Complier mean	7.147	13.562	5.552
Observations	484	484	484
Panel B: High baseline TLU class			
Any insurance purchased	-2.143	-4.744	-0.411
	(2.708)	(5.804)	(1.898)
Controls	✓	✓	✓
Control mean	8.067	17.467	5.884
Complier mean	7.077	11.231	5.666
Observations	258	258	258

Robustness: Without control variables

	Of household members who were school-aged at any point during initial three periods of experiments		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
Any insurance purchased	2.944*	7.068*	2.354*
	(1.536)	(3.707)	(1.293)
Controls			
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	742	742	742
Panel B: Low or middle baseline TLU class			
Any insurance purchased	5.793**	14.360**	4.773**
	(2.377)	(5.720)	(2.092)
Controls			
Control mean	6.917	11.528	5.051
Complier mean	7.147	13.562	5.552
Observations	484	484	484
Panel C: High baseline TLU class			
Any insurance purchased	-1.673	-3.517	-0.452
	(2.518)	(5.930)	(1.877)
Controls			
Control mean	8.067	17.467	5.884
Complier mean	7.077	11.231	5.666
Observations	258	258	258

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

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
Any insurance purchased (in six sales seasons)	3.018	8.209*	2.541
	(1.864)	(4.420)	(1.558)
Controls	✓	✓	✓
Control mean	5.889	8.333	4.833
Complier mean	6.992	12.540	5.499
Observations	742	742	742
Panel B: Low or middle baseline TLU class			
Any insurance purchased (in six sales seasons)	5.406**	14.287**	4.895**
	(2.329)	(5.742)	(2.094)
Controls	✓	✓	✓
Control mean	6.625	9.375	5.438
Complier mean	7.083	13.215	5.494
Observations	484	484	484
Panel C: High baseline TLU class			
Any insurance purchased (in six sales seasons)	-3.948	-8.384	-0.867
	(4.637)	(9.446)	(3.155)
Controls	✓	✓	✓
Control mean	0.000	0.000	0.000
Complier mean	6.828	11.321	5.508
Observations	258	258	258

Robustness: Effects of IBLI uptake in season 1

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
Any insurance purchased – season 1	0.494	2.257	1.352
	(1.406)	(3.332)	(1.145)
Controls	✓	✓	✓
Control mean	7.316	12.977	5.431
Complier mean	7.306	12.936	5.618
Observations	738	738	738
Panel B: Low or middle baseline TLU class			
Any insurance purchased – season 1	1.398	5.779	1.692
	(1.510)	(3.700)	(1.272)
Controls	✓	✓	✓
Control mean	7.018	11.898	5.235
Complier mean	7.459	14.432	5.735
Observations	482	482	482
Panel C: High baseline TLU class			
Any insurance purchased – season 1	-2.750	-8.942	1.279
	(3.817)	(8.272)	(2.941)
Controls	✓	✓	✓
Control mean	7.825	14.825	5.766
Complier mean	6.986	9.817	5.374
Observations	256	256	256

Robustness: Effects of IBLI uptake in seasons 1-2

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
Any insurance purchased – from season 1 to 2	2.484	5.968	2.797*
	(1.829)	(4.312)	(1.520)
Controls	✓	✓	✓
Control mean	7.323	13.208	5.378
Complier mean	7.215	12.755	5.592
Observations	738	738	738
Panel B: Low or middle baseline TLU class			
Any insurance purchased – from season 1 to 2	4.435*	13.760**	4.918**
	(2.440)	(6.110)	(2.177)
Controls	✓	✓	✓
Control mean	7.154	11.600	5.167
Complier mean	7.362	14.062	5.714
Observations	482	482	482
Panel C: High baseline TLU class			
Any insurance purchased – from season 1 to 2	-1.164	-8.967	0.557
	(3.640)	(8.549)	(2.658)
Controls	✓	✓	✓
Control mean	7.677	16.581	5.822
Complier mean	6.909	10.039	5.341
Observations	256	256	256

Robustness: Effects of IBLI uptake in seasons 1-4

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
Any insurance purchased – from season 1 to 4	3.143*	8.848**	2.296*
	(1.675)	(4.196)	(1.387)
Controls	✓	✓	✓
Control mean	8.250	15.542	6.424
Complier mean	6.989	12.285	5.453
Observations	738	738	738
Panel B: Low or middle baseline TLU class			
Any insurance purchased – from season 1 to 4	4.725**	13.729***	3.921**
	(1.980)	(5.118)	(1.736)
Controls	✓	✓	✓
Control mean	7.722	13.500	5.918
Complier mean	7.044	13.148	5.452
Observations	482	482	482
Panel C: High baseline TLU class			
Any insurance purchased – from season 1 to 4	-2.979	-8.437	-1.064
	(4.281)	(8.926)	(2.968)
Controls	✓	✓	✓
Control mean	9.833	21.667	7.944
Complier mean	6.888	10.704	5.455
Observations	256	256	256

Robustness: Effects of IBLI uptake in seasons 1-5

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
Any insurance purchased – from season 1 to 5	3.157*	8.513**	2.481*
	(1.640)	(3.957)	(1.354)
Controls	✓	✓	✓
Control mean	7.667	12.417	6.583
Complier mean	6.892	12.011	5.376
Observations	738	738	738
Panel B: Low or middle baseline TLU class			
Any insurance purchased – from season 1 to 5	6.082***	17.290***	5.089**
	(2.308)	(5.758)	(1.990)
Controls	✓	✓	✓
Control mean	7.222	9.667	6.000
Complier mean	6.905	12.723	5.337
Observations	482	482	482
Panel C: High baseline TLU class			
Any insurance purchased – from season 1 to 5	-3.353	-9.306	-1.071
	(3.019)	(6.597)	(2.195)
Controls	✓	✓	✓
Control mean	9.000	20.667	8.333
Complier mean	6.868	10.674	5.448
Observations	256	256	256

Robustness: Number of IBLI as the endogenous variable

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
N. of IBLI purchased	2.000*	5.074**	1.742**
	(1.049)	(2.544)	(0.871)
Controls	✓	✓	✓
Control mean	5.889	8.333	4.833
Complier mean	6.992	12.540	5.499
Observations	742	742	742
Panel B: Low or middle baseline TLU class			
N. of IBLI purchased	3.981**	10.292***	3.694**
	(1.591)	(3.971)	(1.440)
Controls	✓	✓	✓
Control mean	6.625	9.375	5.438
Complier mean	7.083	13.215	5.494
Observations	484	484	484
Panel C: High baseline TLU class			
N. of IBLI purchased	-1.712	-3.829	-0.330
	(2.227)	(4.807)	(1.533)
Controls	✓	✓	✓
Control mean	0.000	0.000	0.000
Complier mean	6.828	11.321	5.508
Observations	258	258	258

Robustness: Effects on education for younger cohorts

	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: All samples			
Any insurance purchased	1.079	0.275	0.604
	(0.743)	(1.240)	(0.503)
Baseline outcome			
Controls	✓	✓	✓
Control mean	3.203	4.514	2.041
Complier mean	3.619	5.155	2.406
Observations	1015	1015	1015
Panel B: Low or middle baseline TLU class			
Any insurance purchased	1.515	0.144	0.779
	(1.020)	(1.675)	(0.692)
Baseline outcome			
Controls	✓	✓	✓
Control mean	3.145	4.673	2.030
Complier mean	3.621	5.232	2.459
Observations	679	679	679
Panel C: High baseline TLU class			
Any insurance purchased	0.673	2.064	0.505
	(1.054)	(1.741)	(0.701)
Baseline outcome			
Controls	✓	✓	✓
Control mean	3.368	4.053	2.070
Complier mean	3.614	5.007	2.304
Observations	336	336	336

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	2.061	3.276	-6.587	17.411	2.944*	2.906*
	(8.662)	(8.839)	(207.341)	(208.250)	(1.536)	(1.544)
Controls		✓		✓		✓
Control mean	14.979	14.979	591.076	591.076	7.255	7.255
Complier mean	13.889	13.889	541.487	541.487	7.123	7.123
Observations	1179	1179	1179	1179	742	742

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)	(5)	(6)	(7)	(8)
Any insurance purchased	0.120	0.104	0.106	0.106	-0.220**	-0.211**	-0.007	0.005
	(0.089)	(0.088)	(0.082)	(0.081)	(0.095)	(0.094)	(0.051)	(0.050)
Controls		✓		✓		✓		✓
Control mean	0.255	0.255	0.311	0.311	0.293	0.293	0.141	0.141
Complier mean	0.191	0.191	0.427	0.427	0.281	0.281	0.101	0.101
Observations	987	987	987	987	987	987	987	987

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	2.590	-6.107	372.295	401.211	1.797	1.044	-0.328	-0.415	-1.135	-1.109
	(88.734)	(91.418)	(397.133)	(404.225)	(2.867)	(2.683)	(0.523)	(0.510)	(1.446)	(1.448)
Controls		✓		✓		✓		✓		✓
Control mean	207.775	207.775	455.696	455.696	5.503	5.503	0.381	0.381	2.595	2.595
Complier mean	166.827	166.827	431.342	431.342	5.142	5.142	0.765	0.765	2.078	2.078
Observations	1179	1179	1179	1179	1179	1179	781	781	1179	1179

Prespecified secondary outcomes II

	IBLI uptake in the past 12 months (=1 if purchased)		IBLI uptake in the past 12 months (CMVE)		Working		Studying full-time	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased	0.033	0.036	-0.966	-0.936	-0.520	-0.566	0.436*	0.423*
	(0.043)	(0.044)	(0.889)	(0.907)	(0.342)	(0.347)	(0.264)	(0.251)
Controls		✓		✓		✓		✓
Control mean	0.037	0.037	0.308	0.308	0.553	0.553	0.159	0.159
Complier mean	0.064	0.064	0.700	0.700	0.464	0.464	0.221	0.221
Observations	1179	1179	1179	1179	376	376	376	376

Payout effect: Herd composition

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)	
	Large	Small	Large	Small
	(1)	(2)	(3)	(4)
Predicted insurance purchase (γ_1)	0.126	-0.126	4.617	-0.837
	(0.125)	(0.125)	(4.968)	(1.313)
Predicted insurance purchase $\times$ Number of shocks (γ_2)	0.135	-0.135	7.098	1.234
	(0.288)	(0.288)	(7.178)	(1.251)
Number of shocks (γ_3)	-0.0978	0.0978	-4.432	-1.209**
	(0.141)	(0.141)	(3.223)	(0.589)
Coef: $\gamma_1 + \gamma_2$	0.261	-0.261	11.716	0.397
p-val.: $\gamma_1 + \gamma_2$	0.361	0.361	0.115	0.734
Coef: $\gamma_2 + \gamma_3$	0.037	-0.037	2.666	0.026
p-val.: $\gamma_2 + \gamma_3$	0.805	0.805	0.515	0.970
Controls	✓	✓	✓	✓
Control mean	0.566	0.434	9.185	3.617
Complier mean	0.618	0.382	9.385	2.618
Observations	987	987	1179	1179

Payout effect: Herd composition – by baseline TLU

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)	
	Large	Small	Large	Small
Low or middle baseline TLU class				
Predicted insurance purchase (γ_1)	0.132	-0.132	-4.835	-2.954*
	(0.154)	(0.154)	(5.293)	(1.601)
Predicted insurance purchase $\times$ Number of shocks (γ_2)	0.0681	-0.0681	5.414	2.295*
	(0.327)	(0.327)	(6.173)	(1.339)
Number of shocks (γ_3)	-0.0866	0.0866	-3.424	-1.593**
	(0.163)	(0.163)	(2.854)	(0.629)
Coef: $\gamma_1 + \gamma_2$	0.200	-0.200	0.578	-0.659
p-val.: $\gamma_1 + \gamma_2$	0.536	0.536	0.923	0.609
Coef: $\gamma_2 + \gamma_3$	-0.018	0.018	1.990	0.702
p-val.: $\gamma_2 + \gamma_3$	0.913	0.913	0.562	0.344
Controls	✓	✓	✓	✓
Control mean	0.553	0.447	9.968	3.915
Complier mean	0.585	0.415	6.497	2.213
Observations	650	650	790	790
High baseline TLU class				
Predicted insurance purchase (γ_1)	0.0872	-0.0872	21.21**	3.786
	(0.228)	(0.228)	(10.52)	(2.366)
Predicted insurance purchase $\times$ Number of shocks (γ_2)	0.469	-0.469	29.30	-0.373
	(0.669)	(0.669)	(29.93)	(3.528)
Number of shocks (γ_3)	-0.189	0.189	-14.42	-0.685
	(0.321)	(0.321)	(13.37)	(1.672)
Coef: $\gamma_1 + \gamma_2$	0.556	-0.556	50.510	3.413
p-val.: $\gamma_1 + \gamma_2$	0.402	0.402	0.089	0.284
Coef: $\gamma_2 + \gamma_3$	0.279	-0.279	14.882	-1.058
p-val.: $\gamma_2 + \gamma_3$	0.429	0.429	0.379	0.581
Controls	✓	✓	✓	✓
Control mean	0.608	0.392	6.986	2.779
Complier mean	0.679	0.321	15.046	3.412
Observations	337	337	389	389

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)
Predicted insurance purchase (γ_1)	4.086**	9.942**	3.776***
	(1.661)	(4.186)	(1.327)
Predicted insurance purchase $\times$ Number of shocks (γ_2)	-0.176	2.636	-4.786
	(3.539)	(6.066)	(3.254)
Number of shocks (γ_3)	-0.270	-1.670	2.131
	(1.752)	(2.914)	(1.624)
Coef: $\gamma_1 + \gamma_2$	3.910	12.578	-1.010
p-val.: $\gamma_1 + \gamma_2$	0.263	0.031	0.753
Coef: $\gamma_2 + \gamma_3$	-0.447	0.966	-2.655
p-val.: $\gamma_2 + \gamma_3$	0.808	0.772	0.113
Controls	✓	✓	✓
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	742	742	742
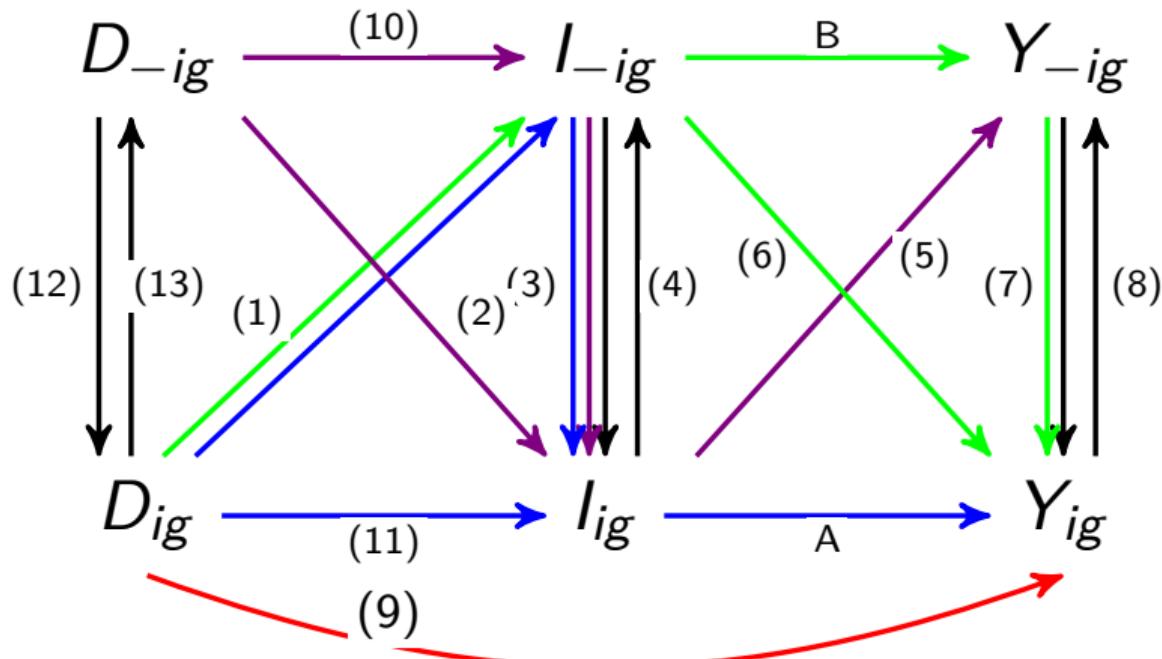
Payout effect: Education – by baseline TLU

	Of household members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
Low or middle baseline TLU class			
Predicted insurance purchase (γ_1)	7.180***	18.50***	6.610***
	(1.961)	(5.293)	(1.586)
Predicted insurance purchase $\times$ Number of shocks (γ_2)	-2.548	-5.768	-5.976
	(3.916)	(6.646)	(3.646)
Number of shocks (γ_3)	0.415	1.891	2.294
	(1.950)	(3.182)	(1.838)
Coef: $\gamma_1 + \gamma_2$	4.632	12.728	0.634
p-val.: $\gamma_1 + \gamma_2$	0.235	0.046	0.862
Coef: $\gamma_2 + \gamma_3$	-2.133	-3.877	-3.682
p-val.: $\gamma_2 + \gamma_3$	0.294	0.300	0.049
Controls	✓	✓	✓
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	484	484	484
Panel B: High baseline TLU class			
Predicted insurance purchase (γ_1)	-2.794	-7.961	-1.293
	(3.155)	(6.820)	(2.429)
Predicted insurance purchase $\times$ Number of shocks (γ_2)	5.807	22.51	-3.206
	(6.946)	(14.01)	(6.194)
Number of shocks (γ_3)	-2.284	-10.57	2.194
	(3.301)	(6.402)	(2.974)
Coef: $\gamma_1 + \gamma_2$	3.014	14.549	-4.500
p-val.: $\gamma_1 + \gamma_2$	0.657	0.290	0.451
Coef: $\gamma_2 + \gamma_3$	3.523	11.942	-1.012
p-val.: $\gamma_2 + \gamma_3$	0.349	0.125	0.760
Controls	✓	✓	✓
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	258	258	258

Effects on migration

	Fully settled	Any satellite camp to feed livestock currently	Plant any crops during gana	Plant any crops during hagaiya
	(1)	(2)	(3)	(4)
Any insurance purchased	-0.014	-0.251	0.026	-0.362
	(0.106)	(0.265)	(0.277)	(0.280)
Controls	✓	✓	✓	✓
Control mean	0.550	0.217	0.217	0.174
Complier mean	0.589	0.123	0.196	0.089
Observations	1179	398	398	398

Potential spillover interactions

Summary statistics of the spillover variables

	Kenya			Ethiopia			Pooled		
	Mean/SD	Min	Max	Mean/SD	Min	Max	Mean/SD	Min	Max
D_{ij}: No. of coupons received	1.78 [0.87]	0.00	3.00	1.57 [0.60]	0.00	2.00	1.71 [0.79]	0.00	3.00
I_{ij}: Any insurance purchase	0.43 [0.50]	0.00	1.00	0.45 [0.50]	0.00	1.00	0.44 [0.50]	0.00	1.00
$\overline{D}_{-ij}$: No. of coupons received	100.88 [41.15]	44.00	160.00	40.22 [12.85]	3.00	68.00	80.41 [44.73]	3.00	160.00
$\overline{I}_{-ij}$: No. of peers who purchased any insurance	22.83 [10.32]	8.00	50.00	11.38 [4.94]	0.00	19.00	18.96 [10.40]	0.00	50.00
Share of populaiton that was treated in the community	0.04 [0.03]	0.01	0.20	0.13 [0.08]	0.00	0.35	0.07 [0.07]	0.00	0.35

Social spillovers and mechanical correlations

	Outcome: Any insurance purchase - first three seasons					
	I_{ij}: Recipient's			$\overline{I}_{-ij}$: Peers'		
	(1)	(2)	(3)	(4)	(5)	(6)
D_{ij}: Recipient's number of coupons received	0.119***		0.119***	-0.064		-0.107
	(0.017)		(0.017)	(0.283)		(0.180)
$\overline{D}_{-ij}$: Number of peers receiving coupons		-0.002***	-0.002***		0.160***	0.160***
		(0.000)	(0.000)		(0.005)	(0.005)
Pathway (DAG)	(11)	(2)	(2);(11)	(1)	(10)	(1);(10)
Recipient controls (i)						
Peers' controls (-i)	✓	✓	✓	✓	✓	✓
Community FE						
(Control) mean outcomes	0.237	.	0.237	20.288	.	.
Observations	1179	1179	1179	1179	1179	1179

Spillover effects on herd composition

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I_ij: Any insurance purchase	0.231*	-0.231*	6.274	-1.234	-2.123	-3.269*	16.872**	2.256
	(0.122)	(0.122)	(4.817)	(1.193)	(5.697)	(1.704)	(8.189)	(1.685)
I_{-ij}: No. of peers who purchased any insurance	-0.001	0.001	-0.061	-0.026	-0.110	-0.028	0.237	0.036
	(0.003)	(0.003)	(0.087)	(0.025)	(0.079)	(0.027)	(0.289)	(0.068)
Recipient controls (i)								
Peers' controls (-i)	✓	✓	✓	✓	✓	✓	✓	✓
Community FE								
Control mean	0.566	0.434	9.185	3.617	9.968	3.915	6.986	2.779
Complier mean	0.618	0.382	9.385	2.618	6.497	2.213	15.046	3.412
Sample (Baseline TLUs)	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Observations	987	987	1179	1179	790	790	389	389

Spillover effects on education outcomes

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
$\widehat{I}_{ij}$: Any insurance purchase	3.266**	8.110**	2.604*
	(1.648)	(3.938)	(1.387)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	0.117***	0.318***	0.090***
	(0.037)	(0.088)	(0.031)
Recipient controls (i)			
Peer's controls (-i)	✓	✓	✓
Community FE			
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	742	742	742

Spillover effects on education outcomes – by baseline TLU

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
Low or middle baseline TLU class			
I_{ij}: Any insurance purchase	6.779**	16.700***	5.433**
	(2.771)	(6.465)	(2.391)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	0.166***	0.411***	0.123***
	(0.054)	(0.125)	(0.044)
Recipient controls (i)			
Peer's controls (-i)	✓	✓	✓
Community FE			
Control mean	6.917	11.528	5.051
Complier mean	7.147	13.562	5.552
Observations	484	484	484
High baseline TLU class			
I_{ij}: Any insurance purchase	-1.553	-3.390	-0.686
	(2.447)	(5.697)	(1.827)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	-0.023	0.046	0.004
	(0.076)	(0.174)	(0.061)
Recipient controls (i)			
Peer's controls (-i)	✓	✓	✓
Community FE			
Control mean	8.067	17.467	5.884
Complier mean	7.077	11.231	5.666
Observations	258	258	258

Spillover effects on child time use

	Share of children in the household	
	Working	Studying full-time
	(1)	(2)
$\widehat{I}_{ij}$: Any insurance purchase	-0.595	0.569
	(0.494)	(0.524)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	-0.131	0.180
	(0.118)	(0.128)
Recipient controls (i)		
Peer's controls (-i)	✓	✓
Community FE		
Control mean	0.553	0.159
Complier mean	0.464	0.221
Observations	376	376

Dynamics: Herd share over time

	N of animals (CMVE) / Total herd size (CMVE)					
	Large			Small		
	3rd sales season	End of experiment	10-year long-run	3rd sales season	End of experiment	10-year long-run
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased	0.060	0.062	0.209*	-0.060	-0.062	-0.209*
	(0.063)	(0.064)	(0.112)	(0.063)	(0.064)	(0.112)
Controls	✓	✓	✓	✓	✓	✓
Control mean	0.647	0.616	0.566	0.353	0.384	0.434
Observations	1085	1069	987	1085	1069	987

Dynamics: Herd composition over time

	Number of animals (CMVE)					
	Large			Small		
	3rd sales season	End of experiment	10-year long-run	3rd sales season	End of experiment	10-year long-run
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All samples						
Any insurance purchased	-1.318	-0.156	6.316	-0.798	-1.511	-0.865
	(3.278)	(2.716)	(4.447)	(1.130)	(1.141)	(1.094)
Controls	✓	✓	✓	✓	✓	✓
Control mean	12.664	10.888	9.185	4.276	4.611	3.617
Complier mean	12.612	12.634	9.385	3.991	4.222	2.618
Observations	1165	1151	1179	1165	1151	1179
Panel B: Low or middle baseline TLU class						
Any insurance purchased	0.845	-0.601	-2.007	-0.470	-2.797*	-2.591*
	(3.802)	(2.890)	(5.069)	(1.281)	(1.438)	(1.541)
Controls	✓	✓	✓	✓	✓	✓
Control mean	9.588	9.440	9.968	3.567	4.288	3.915
Complier mean	8.739	9.305	6.497	3.377	3.830	2.213
Observations	776	767	790	776	767	790
Panel C: High baseline TLU class						
Any insurance purchased	-7.171	-1.546	13.827*	-1.235	0.498	1.666
	(5.610)	(5.315)	(7.819)	(1.926)	(2.057)	(1.583)
Controls	✓	✓	✓	✓	✓	✓
Control mean	20.133	14.471	6.986	5.997	5.410	2.779
Complier mean	20.026	19.006	15.046	5.166	4.972	3.412
Observations	389	384	389	389	384	389

Dynamics: Educational attainment over time

	Maximum years of education			Total years of education			Average years of education		
	3rd sales season	End of experiment	10-year long-run	3rd sales season	End of experiment	10-year long-run	3rd sales season	End of experiment	10-year long-run
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: All samples									
Any insurance purchased	-0.126	-0.283	2.906*	-0.632	0.168	7.314**	-0.014	0.144	2.520**
	(0.528)	(0.575)	(1.544)	(0.907)	(0.831)	(3.704)	(0.229)	(0.213)	(1.276)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	1.724	2.119	7.255	2.552	2.814	13.275	0.616	0.639	5.296
Complier mean	1.567	1.613	7.123	2.476	2.655	12.746	0.697	0.769	5.592
Observations	1041	1048	742	1041	1048	742	1041	1048	742
Panel B: Low or middle baseline TLU class									
Any insurance purchased	0.034	0.253	5.658**	-0.714	0.780	14.535**	0.067	0.330	5.254**
	(0.652)	(0.633)	(2.337)	(1.167)	(0.946)	(5.723)	(0.305)	(0.273)	(2.124)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	1.488	1.262	6.917	2.341	1.857	11.528	0.602	0.483	5.051
Complier mean	1.367	1.395	7.147	2.075	2.194	13.562	0.610	0.688	5.552
Observations	684	690	484	684	690	484	684	690	484
Panel C: High baseline TLU class									
Any insurance purchased	0.067	-0.364	-2.143	0.127	0.493	-4.744	0.073	0.151	-0.411
	(0.900)	(1.028)	(2.708)	(1.455)	(1.507)	(5.804)	(0.384)	(0.361)	(1.898)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	2.294	4.235	8.067	3.059	5.176	17.467	0.649	1.023	5.884
Complier mean	1.944	2.018	7.077	3.236	3.512	11.231	0.863	0.919	5.666
Observations	357	358	258	357	358	258	357	358	258

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 small animals 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 routinely manage smaller animals, while large animals are managed by adult men.
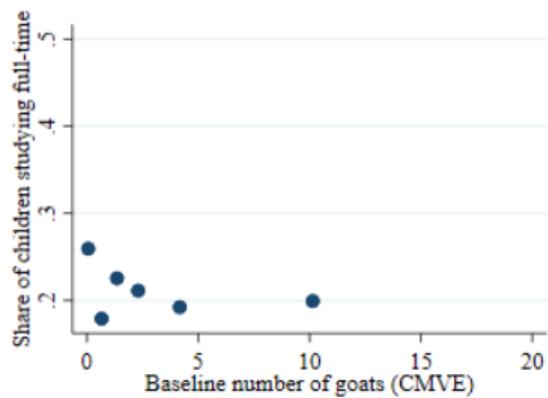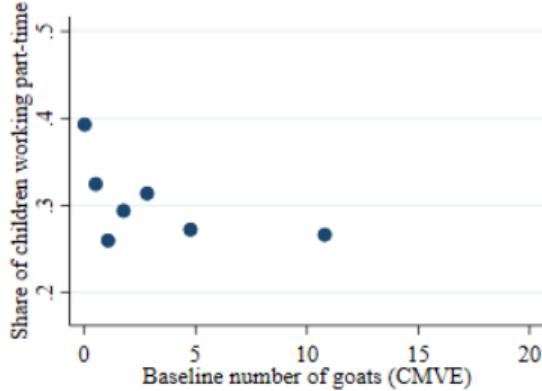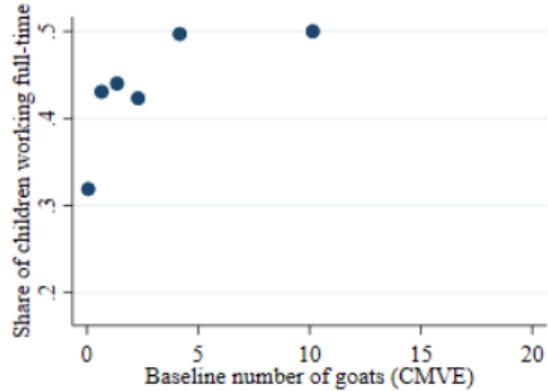
- Changes in production strategies **decreases the marginal productivity of child labor**, which, together with suggestive income effects, boosts investments in education
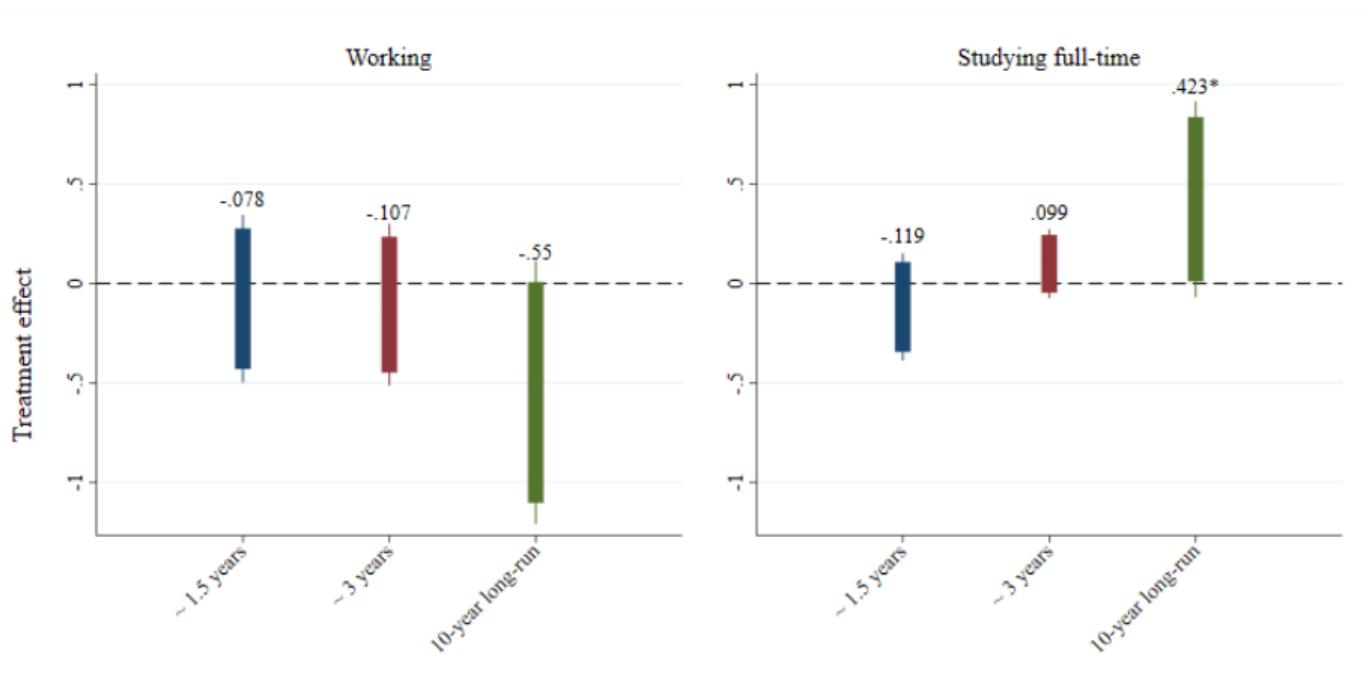
Short-run impact on secondary livestock related outcomes

	Herd management expenditure (USD)	Milk Income (USD)	Livestock loss (CMVE)	Distress sales (CMVE)	Livestock Sale (CMVE)
	(1)	(2)	(3)	(4)	(5)
Panel A: All samples					
Any insurance purchased	6.582	2.518	-0.020	0.085	-1.208
	(35.388)	(3.938)	(2.762)	(1.587)	(2.335)
Controls	✓	✓	✓	✓	✓
Control mean	57.355	9.306	7.325	2.457	6.240
Complier mean	45.165	10.368	6.401	3.198	6.465
Sample	All	All	All	All	All
Observations	1156	1165	1085	1096	1096
Panel B: Low or middle baseline TLU class					
Any insurance purchased	82.112*	-2.624	-0.961	-0.552	-0.949
	(47.831)	(3.719)	(3.078)	(1.825)	(2.473)
Controls	✓	✓	✓	✓	✓
Control mean	41.385	8.841	5.617	2.824	5.829
Complier mean	43.052	6.490	5.336	2.336	4.899
Observations	771	776	715	721	721
Panel C: High baseline TLU class					
Any insurance purchased	-105.817*	10.973	1.721	1.300	-0.024
	(56.263)	(8.076)	(5.163)	(3.259)	(4.712)
Controls	✓	✓	✓	✓	✓
Control mean	95.380	10.434	11.281	1.595	7.205
Complier mean	49.231	17.791	8.414	4.819	9.411
Observations	385	389	370	375	375

Child time use and number of goats at baseline survey

Dynamics: Child time use over time

◄ Back

Dynamics: Child time use over time

	Working			Studying full-time		
	1.5 years	3 years	10-year long-run	1.5 years	3 years	10-year long-run
	(1)	(2)	(3)	(4)	(5)	(6)
Any insurance purchased	-0.078	-0.107	-0.550	-0.119	0.099	0.423*
	(0.215)	(0.208)	(0.338)	(0.137)	(0.088)	(0.251)
Controls	✓	✓	✓	✓	✓	✓
Control mean	0.699	0.795	0.553	0.223	0.131	0.159
Complier mean	0.762	0.799	0.464	0.175	0.143	0.221
Observations	369	375	376	369	375	376

Changes in education and shoats over time

	Full sample	Subsample by reduction in small ruminants			Pairwise t-test		
		Sharp reduction (>.75)	Moderate reduction (<=.75)	No reduction	(2)-(3)	(3)-(4)	(2)-(4)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change in maximum years of education	3.66	4.13	3.76	2.80	0.37	0.96*	1.33***
	[4.46]	[4.27]	[4.69]	[4.43]			
Change in total years of education	6.46	8.12	5.72	4.44	2.40**	1.27	3.68***
	[9.90]	[10.62]	[9.45]	[8.60]			
Change in average years of education	3.54	4.04	3.42	2.83	0.62	0.59	1.21***
	[3.54]	[3.59]	[3.49]	[3.39]			
Observations	742	339	197	206	536	403	545

Social spillovers and mechanical correlations with control variables

	Outcome: Any insurance purchase - first three seasons					
	I_{ij}: Recipient's			$\bar{I}_{-ij}$: Peers'		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: With both own and peers' control variables						
D_{ij}: Recipient's number of coupons received	0.117***		0.118***	-0.093		-0.134
	(0.017)		(0.017)	(0.285)		(0.182)
$\bar{D}_{-ij}$: Number of peers receiving coupons		-0.002***	-0.002***		0.159***	0.159***
		(0.000)	(0.000)		(0.005)	(0.005)
Pathway (DAG)	(11)	(2)	(2);(11)	(1)	(10)	(1);(10)
Recipient controls (i)	✓	✓	✓	✓	✓	✓
Peers' controls (-i)	✓	✓	✓	✓	✓	✓
Community FE						
(Control) mean outcomes	0.237	.	0.237	20.288	.	.
Observations	1179	1179	1179	1179	1179	1179
	I_{ij}: Recipient's			$\bar{I}_{-ij}$: Peers'		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel B: With own control variables						
D_{ij}: Recipient's number of coupons received	0.120***		0.122***	0.481		0.114
	(0.017)		(0.017)	(0.400)		(0.296)
$\bar{D}_{-ij}$: Number of peers receiving coupons		-0.001***	-0.001***		0.167***	0.167***
		(0.000)	(0.000)		(0.007)	(0.007)
Pathway (DAG)	(11)	(2)	(2);(11)	(1)	(10)	(1);(10)
Recipient controls (i)	✓	✓	✓	✓	✓	✓
Peers' controls (-i)						
Community FE						
(Control) mean outcomes	0.237	.	0.237	20.288	.	.
Observations	1179	1179	1179	1179	1179	1179

Spillover effects on herd composition with control variables

	Number of animal type / Total number of animals (CMVE)		Number of animals (CMVE)					
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: With both own and peers' control variables								
I_{ij}: Any insurance purchase	0.128	-0.128	5.152	-1.068	-4.677	-3.385*	17.506**	2.341
	(0.110)	(0.110)	(4.632)	(1.163)	(5.563)	(1.754)	(7.523)	(1.503)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	-0.002	0.002	-0.118*	-0.009	-0.145**	-0.005	0.057	0.024
	(0.002)	(0.002)	(0.069)	(0.017)	(0.059)	(0.019)	(0.225)	(0.050)
Recipient controls (i)	✓	✓	✓	✓	✓	✓	✓	✓
Peers' controls (-i)								
Community FE								
Control mean	0.566	0.434	9.185	3.617	9.968	3.915	6.986	2.779
Complier mean	0.618	0.382	9.385	2.618	6.497	2.213	15.046	3.412
Sample	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Observations	987	987	1179	1179	790	790	389	389
	Large	Small	Large	Small	Large	Small	Large	Small
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel B: With own control variables								
I_{ij}: Any insurance purchase	0.128	-0.128	5.152	-1.068	-4.677	-3.385*	17.506**	2.341
	(0.110)	(0.110)	(4.632)	(1.163)	(5.563)	(1.754)	(7.523)	(1.503)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	-0.002	0.002	-0.118*	-0.009	-0.145**	-0.005	0.057	0.024
	(0.002)	(0.002)	(0.069)	(0.017)	(0.059)	(0.019)	(0.225)	(0.050)
Recipient controls (i)	✓	✓	✓	✓	✓	✓	✓	✓
Peers' controls (-i)								
Community FE								
Control mean	0.566	0.434	9.185	3.617	9.968	3.915	6.986	2.779
Complier mean	0.618	0.382	9.385	2.618	6.497	2.213	15.046	3.412
Sample	All	All	All	All	Bottom 2/3	Bottom 2/3	Top 1/3	Top 1/3
Observations	987	987	1179	1179	790	790	389	389

Spillover effects on education outcomes with control variables

	Of households members who were school-aged during the experiment		
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel A: With both own and peers' control variables			
$\bar{I}_{ij}$: Any insurance purchase	3.316*	8.602**	2.855**
	(1.692)	(4.017)	(1.397)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	0.124***	0.341***	0.099***
	(0.036)	(0.086)	(0.030)
Recipient controls (i)	✓	✓	✓
Peer's controls (-i)	✓	✓	✓
Community FE			
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	742	742	742
	Maximum years of education	Total years of education	Average years of education
	(1)	(2)	(3)
Panel B: With own control variables			
$\bar{I}_{ij}$: Any insurance purchase	3.440**	8.883**	2.821**
	(1.622)	(3.966)	(1.336)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	0.125***	0.342***	0.091***
	(0.026)	(0.062)	(0.021)
Recipient controls (i)	✓	✓	✓
Peer's controls (-i)			
Community FE			
Control mean	7.255	13.275	5.296
Complier mean	7.123	12.746	5.592
Observations	742	742	742

Spillover effects on child time use with control variables

	Share of children in the household	
	Working	Studying full-time
	(1)	(2)
Panel A: With both own and peers' control variables		
$\bar{I}_{ij}$: Any insurance purchase	-0.841	0.695
	(0.687)	(0.581)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	-0.174	0.182
	(0.155)	(0.144)
Recipient controls (i)	✓	✓
Peer's controls (-i)	✓	✓
Community FE		
Control mean	0.553	0.159
Complier mean	0.464	0.221
Observations	376	376
Panel B: With own control variables		
$\bar{I}_{ij}$: Any insurance purchase	-0.841	0.695
	(0.687)	(0.581)
$\bar{I}_{-ij}$: No. of peers who purchased any insurance	-0.174	0.182
	(0.155)	(0.144)
Recipient controls (i)	✓	✓
Peer's controls (-i)	✓	✓
Community FE		
Control mean	0.553	0.159
Complier mean	0.464	0.221
Observations	376	376