

Long-run Effects of Catastrophic Drought Insurance

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IFPRI Applied Microeconomics and Development Seminar

May 29, 2024

Motivation

- Uninsured exposure to disaster risk may discourage investment. (Boucher et al., 2008; Emerick et al., 2016)
- Catastrophic aggregate shocks have negative long-run impacts on lifetime 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).
 - 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 increasingly points to insurance market failures as 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 remains 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 (and despite only temporary use)**.
 - 82% of the original panel households were re-interviewed.
 - Primary outcomes of interests include income, assets, productive strategies, and human capital accumulation. (Pre-analysis plan: AEARCTR-0011184)
- Identification comes from **randomized premium discounts** are used to estimate the LATE of insurance coverage **in the first three years** on our pre-specified outcomes ten years after initial IBLI exposure.

We investigate robustness to potential spillovers, the dynamics of effects, and *ex ante* coverage or *ex post* payouts as mechanisms.

What we find

Long-run impacts of IBLI

- Herd composition changes: a 83% reduction in smaller animals (e.g., goats) towards larger animals (especially camels).
- A substantial increase in age-appropriate educational attainment, from $\sim 12\%$ to $\sim 28\%$.
- A tripling of the share of current children studying full time, from 23% to about 70%.
- A large (32.6%), imprecisely estimated increase in income w/no herd size growth.
- The first two are robust to controlling for potential social spillovers.

Mechanisms

- There is **no** effect of initial adoption on recent adoption. Seems a supply-side problem.
- *Ex post* indemnity payments do not affect outcomes. Instead, effects arise through changes in *ex ante* risk exposure and induced behavior change.
- The effect on herd composition and educational attainment materialized promptly, and both effects grew after experiment ended.

Contribution to the literature - I

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](#))
- **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.

Contribution to the literature - II

Literature on the impacts of index insurance

- Short-run *ex ante* behavioral changes
 - Producers are risk averse and reluctant to invest in risky production without insurance (Boucher et al. 2008; Emerick et al., 2016)
 - Despite product quality and/or implementation constraints of many insurance products, many find increases in productive investments (Karlán et al., 2014; Jensen et al 2017; Cole et al., 2017; Matsuda et al., 2019; Hill et al. 2019; Belissa et al. 2020; Mishra et al 2021; Stoeffler et al., 2022; Son, 2023)
- Short-run *ex post* shock response
 - Increase in income and consumption smoothing (Matsuda et al., 2019; Janzen et al., 2019; Jensen et al., 2017, Noritomo et al., 2020)
- **Contribution:**
 - Persistence of changes in production strategies and resulting long-run increases in education.

Road Map

- 1 Introduction
- 2 Setting, Intervention and Research Design**
- 3 IV validity, Balance, and Attrition
- 4 Pre-specified Results
- 5 Robustness
- 6 Mechanisms
- 7 Conclusions

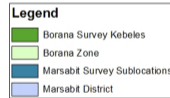
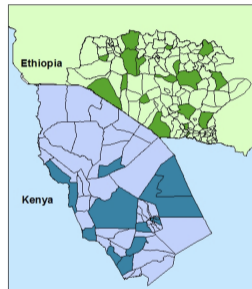
Setting: Northern Kenya (Marsabit) and Southern Ethiopia (Borena)

Livestock grazing and drought

- ASAL residents rely on extensive livestock grazing.
- Drought-related starvation and dehydration account for 47% of livestock losses.

Risk management and self-insurance

- Seasonal migration
- Inter-household gifts and loans are insufficient because all are similarly affected.
- Covariate shocks causes livestock prices to fall, so market magnifies rather than stabilizes income relative to animal productivity.
- Prior to IBLI, formal finance was largely unavailable.



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	

Intervention: Index-Based Livestock Insurance (IBLI)

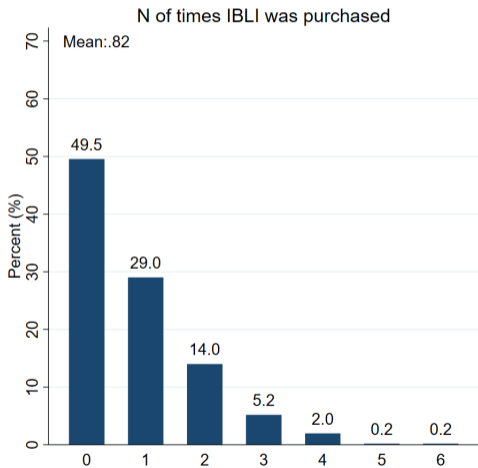
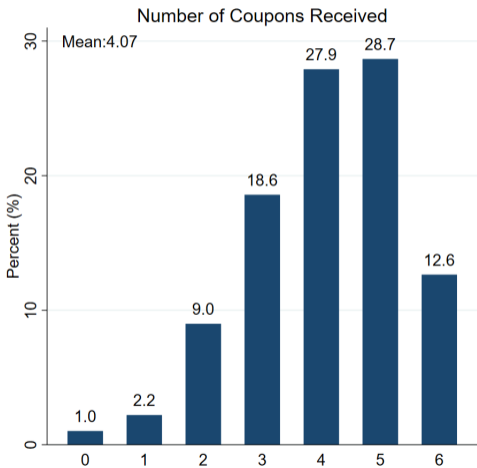
Product

- 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 readings 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 and 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.

Discount coupons and insurance uptake



► Correlation

Estimation strategy: First stage

We instrument 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:

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

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.

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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 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 are female-headed, that have fewer adults, and that do not own agricultural land were more likely to attrit from the sample. [▶ Selective attrition](#)

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First stage regression results

	Any insurance purchased – first three seasons						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No. of coupons received – first three seasons	0.123*** (0.016)						
Received coupon – first season		0.167*** (0.029)					
Received coupon – second season			0.069** (0.030)				
Received coupon – third season				0.064** (0.030)			
Received coupon – fourth season					0.004 (0.030)		
Received coupon – fifth season						-0.014 (0.031)	
Received coupon – sixth season							-0.049 (0.035)
Controls	✓	✓	✓	✓	✓	✓	✓
Effective F-stat	56.522	32.837	5.294	4.639	0.020	0.213	1.937
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

Primary outcomes: Herd size, cash earnings, education

	Herd size (CMVE)	Annual household cash earnings (USD)	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)
Any insurance purchased	3.308 (8.856)	5.497 (209.810)	0.168** (0.084)
Controls	✓	✓	✓
Control mean	14.265	529.673	0.115
Observations	1179	1179	762

▶ Education - other ▶ Education - gender

▶ All seasons IV ▶ Education sample

▶ Income ▶ Income - extensive margin ▶ Income - total livestock and crop

▶ Heterogeneity - country ▶ Heterogeneity - herd size ▶ Heterogeneity - gender household head

Primary outcomes: Herd composition

	Outcome: N of animal type in CMVE / Total N of animals in CMVE			
	Camel	Cattle	Goats	Sheep
	(1)	(2)	(3)	(4)
Any insurance purchased	0.120 (0.092)	0.107 (0.083)	-0.235** (0.097)	0.009 (0.052)
Controls	✓	✓	✓	✓
Control mean	0.263	0.332	0.284	0.121
Observations	987	987	987	987

▶ Large vs. small ruminants

▶ N of animals - by each species

▶ N of animals - Large vs. small ruminants

▶ All seasons IV

▶ Education sample

Secondary outcomes:

	Herd management expenditure (USD)	Milk Income	Livestock loss (CMVE)	Distress sales (CMVE)	Livestock Sale (CMVE)
	(1)	(2)	(3)	(4)	(5)
Any insurance purchased	2.634 (89.841)	377.169 (401.425)	1.840 (2.802)	-0.389 (0.532)	-1.078 (1.449)
Controls	✓	✓	✓	✓	✓
Control mean	167.891	359.879	5.448	0.292	1.872
Observations	1179	1179	1179	781	1179

Secondary outcomes:

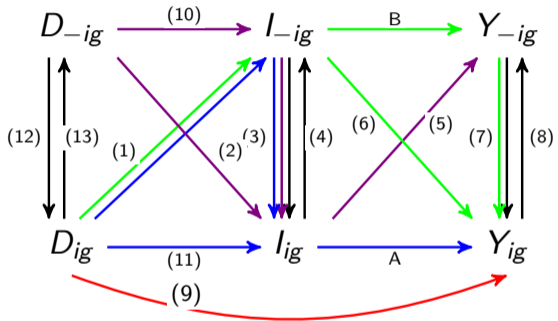
	IBLI uptake in the past 12 months (=1 if purchased)	IBLI uptake in the past 12 months (CMVE)	Working full-time	Working part-time	Studying full-time
	(1)	(2)	(3)	(4)	(5)
Any insurance purchased	0.036 (0.044)	-0.949 (0.940)	-0.322 (0.280)	-0.261 (0.254)	0.467* (0.278)
Controls	✓	✓	✓	✓	✓
Control mean	0.042	0.539	0.271	0.201	0.232
Observations	1179	1179	376	376	376

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Robustness – Social spillovers

- Individual-level randomization: potential violation of SUTVA.
- Multiple potential spillover pathways exist.
 - Existence of **first-stage spillovers** could lead to violation of *exclusion restriction*.
 - ▶ 1st stg spillover
 - **Second-stage spillovers** would not violate IV assumptions, only lead to an underestimate.
- Mechanical correlation and spillovers cannot be separately identified.
- We only have exogenous variation in D_{ig} and D_{-ig} to identify first-stage spillovers.



Spillover effects on herd size, earnings, education

	Herd size (CMVE)		Annual household cash earnings (USD)		Share of members who completed age-appropriate years of education	
	(1)	(2)	(3)	(4)	(5)	(6)
$\hat{\tau}_{ij}$: Any insurance purchase - first three seasons	5.993 (10.628)	1.822 (8.917)	7.840 (224.607)	10.333 (212.845)	0.147 (0.090)	0.150* (0.088)
$\hat{\tau}_{-ij}$: Peers' any insurance purchase – first three season	111.870*** (41.550)	15.771 (15.849)	-569.251 (1217.766)	762.414 (501.433)	-0.376 (0.873)	-0.057 (0.302)
Recipient controls (i)	✓		✓		✓	
Peers' controls (-i)		✓		✓		✓
Control mean	14.265	14.265	529.673	529.673	0.115	0.115
Village FE						
Observations	1179	1179	1179	1179	762	762

Spillover effects on 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)
\hat{I}_{ij} : Any insurance purchase - first three seasons	0.090 (0.099)	0.131 (0.096)	0.186 (0.487)	0.119 (0.087)	-0.261 (0.200)	-0.240** (0.105)	-0.008 (0.091)	-0.009 (0.053)
\hat{I}_{-ij} : Peers' any insurance purchase - first three season	-0.637 (0.536)	-0.056 (0.256)	8.798 (6.668)	0.454 (0.312)	-2.636*** (0.925)	-0.328 (0.300)	-1.430 (0.908)	-0.168 (0.159)
Recipient controls (i)	✓		✓		✓		✓	
Peers' controls (-i)		✓		✓		✓		✓
Control mean	0.263	0.263	0.332	0.332	0.284	0.284	0.121	0.121
Village FE								
Observations	987	987	987	987	987	987	987	987

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Payout effect: Herd size, earnings, education

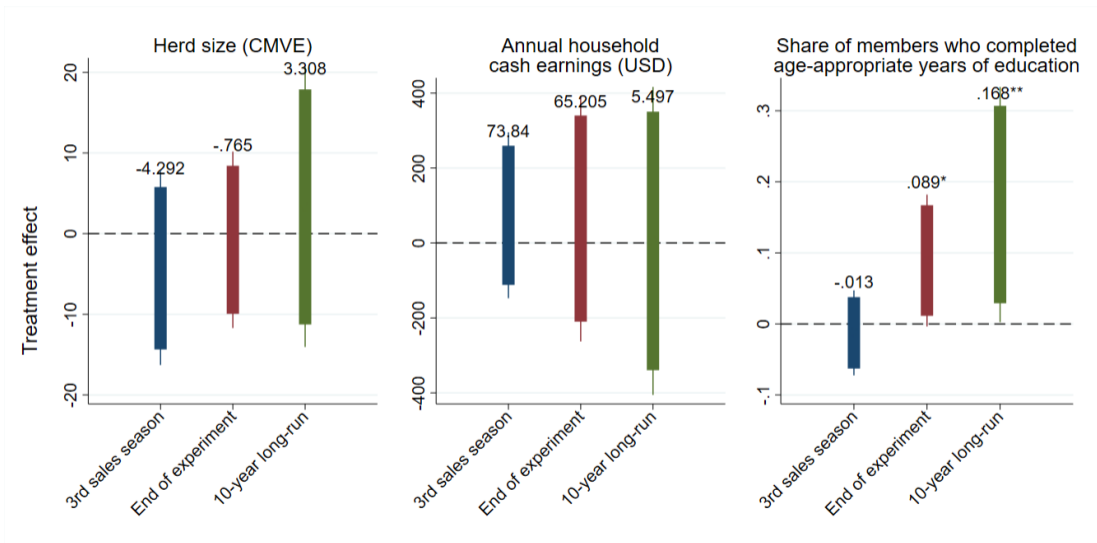
	Herd size (CMVE)	Annual household cash earnings (USD)	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)
Any insurance purchased (γ_1)	3.468 (9.169)	9.794 (215.3)	0.180** (0.0870)
Any insurance purchased \times Indemnity rate (γ_2)	-16.47 (38.79)	-439.8 (2344.3)	-1.277 (0.998)
Coef: $\gamma_1 + \gamma_2$	-13.002	-429.972	-1.097
p-val.: $\gamma_1 + \gamma_2$	0.681	0.851	0.261
Controls	✓	✓	✓
Control mean	14.265	529.673	0.115
Observations	1179	1179	762

$$y_{ijT} = \gamma_0 + \gamma_1 \hat{l}_{ij} + \gamma_2 \hat{l}_{ij} \times R_{jt} + \gamma_3 y_{ij0} + \gamma_4 X_{ij0} + \gamma_5 D_{ij4}^T + \rho_j + \varepsilon_{ijT} \quad (3)$$

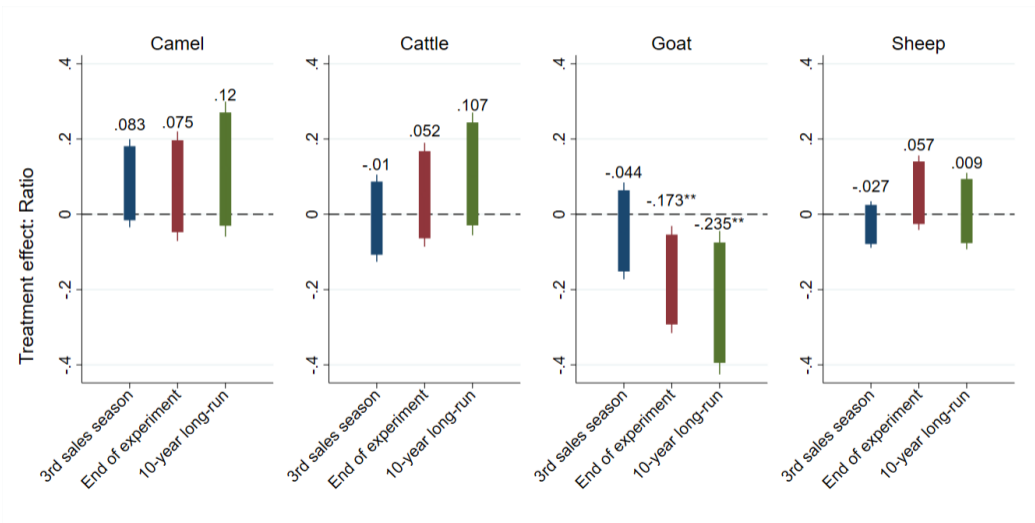
Payout effect: Herd composition

	Outcome: N of animal type in CMVE / Total N of animals in CMVE			
	Camel	Cattle	Goats	Sheep
	(1)	(2)	(3)	(4)
Any insurance purchased (γ_1)	0.118 (0.0935)	0.115 (0.0832)	-0.242** (0.0989)	0.00841 (0.0531)
Any insurance purchased \times Indemnity rate (γ_2)	0.180 (0.791)	-0.785 (1.538)	0.780 (1.228)	0.0186 (0.224)
Coef: $\gamma_1 + \gamma_2$	0.298	-0.670	0.538	0.027
p-val.: $\gamma_1 + \gamma_2$	0.697	0.662	0.658	0.890
Controls	✓	✓	✓	✓
Control mean	0.263	0.332	0.284	0.121
Observations	987	987	987	987

Dynamics: Primary outcomes over time



Dynamics: The share of individual animal types over time



Suggested interpretation

- Goats are “cash with four legs” (~ 10 USD). Many households report liquidating goats to pay IBLI premium: “*sell a goat to insure a cow*”. But that can only account for a small share of herd composition shift.
- Insurance reduced the need for precautionary saving to cover drought-related expenditures. So less need to hold goats.
- By reducing risk of loss of higher-value, lumpier large stock, IBLI induced households to re-balance livestock portfolio. Result is (insignif.) much higher income.
- Children routinely manage goats, while camels 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

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Conclusions

- We study the long-run effects of insurance against catastrophic drought shocks.
 - one of the few actively working, scaled examples of index insurance of assets against covariate weather shocks,
 - previously shown to have positive short-term effects on many outcomes.
- 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: Share household members w/ age-appropriate education grew
- Had no effect on herd size, w/ insignificant but large impact on total income
- Insurance has potential to 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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Summary statistics of the outcomes at baseline

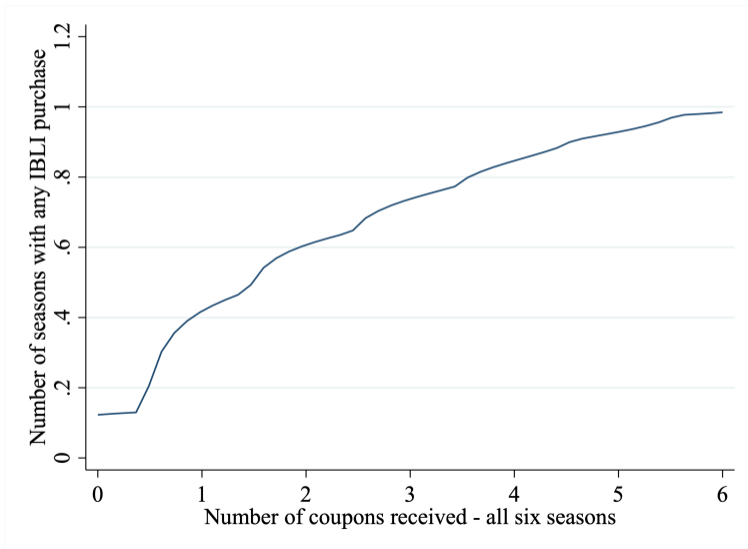
Primary outcomes

	Mean	[SD]
<i>Baseline prespecified primary outcomes</i>		
Share of camels in herd (CMVE)	0.23	[0.29]
Share of cattle in herd (CMVE)	0.43	[0.37]
Share of goats in herd (CMVE)	0.22	[0.24]
Share of sheep in herd (CMVE)	0.11	[0.15]
Annual total household cash earning (USD)	498.44	[757.52]
Share of members who completed age-appropriate years of education	0.11	[0.24]
Observations	1179	

Secondary outcomes

	Mean	[SD]
<i>Baseline prespecified secondary outcomes</i>		
Herd management expenditure (USD)	46.16	[146.17]
Annual milk income (USD)	641.56	[1408.50]
Livestock lost in the past 12 months (CMVE)	10.49	[15.79]
N of lost camel	0.87	[3.00]
N of lost cattle	5.92	[13.11]
N of lost goats/sheep	23.93	[47.39]
Distress sale in the past 12 months (CMVE)	3.12	[11.99]
Share of children working full-time	0.40	[0.37]
Share of children working part-time	0.28	[0.37]
Share of children studying full-time	0.18	[0.32]
Observations	1179	

Correlations between discount coupons and insurance uptake



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
<i>Baseline prespecified primary outcomes</i>				
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]
Share of members who completed age-appropriate years of education	0.12	[0.24]	0.11	[0.22]
Observations	781		398	

Secondary outcomes

	Kenya		Ethiopia	
	Mean/SD	Obs	Mean/SD	Obs
<i>Baseline prespecified secondary outcomes</i>				
Herd management expenditure (USD)	48.79	[153.93]	41.00	[129.63]
Milk income	202.86	[717.04]	6.96	[29.65]
Livestock loss (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 sales (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	

Balance of coupon distribution

	Received coupon vs. No coupon						
	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)
Sales Season Kenya:							
Sales Season Ethiopia:							
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	

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	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

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

Checking monotonicity assumption

Number of coupons recipient's received	Number of seasons purchase IBLI			
	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

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

First stage using all six sales seasons

	Any insurance purchased – first three 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			0.096*** (0.030)				
Received coupon – third season				0.040 (0.029)			
Received coupon – fourth season					0.005 (0.030)		
Received coupon – fifth season						0.012 (0.030)	
Received coupon – sixth season							-0.007 (0.035)
Controls	✓	✓	✓	✓	✓	✓	✓
Effective F-stat	33.028	21.165	10.085	1.821	0.026	0.148	0.039
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

Education - School-aged during experiment

	Maximum years of education	Total years of education	Average years of education	Share of household members				
				who completed age-appropriate years of education	who completed any schooling	who completed 4 years of primary education	who completed primary education	who completed secondary education
				(1)	(2)	(3)	(4)	(5)
Any insurance purchased	1.964 (1.348)	4.842 (3.025)	2.303** (1.112)	0.168** (0.084)	0.208* (0.122)	0.162 (0.126)	0.142 (0.111)	0.002 (0.049)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	6.715	8.488	4.860	0.115	0.646	0.549	0.204	0.033
Observations	770	1179	770	762	770	770	770	770

Education - Male child vs. Female child

	Male				Female			
	Maximum years of education	Total years of education	Average years of education	Share of members who completed age-appropriate years of education	Maximum years of education	Total years of education	Average years of education	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased	0.137 (0.095)	3.901** (1.647)	6.314** (3.171)	3.115** (1.389)	0.141 (0.129)	0.624 (1.333)	0.279 (2.660)	0.952 (1.291)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	0.108	6.289	8.668	4.900	0.144	6.186	8.135	5.557
Observations	530	533	533	533	435	427	427	427

Education - Male child vs. Female child

	Male				Female			
	Maximum years of education	Total years of education	Average years of education	Share of members who completed age-appropriate years of education	Maximum years of education	Total years of education	Average years of education	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Any insurance purchased	0.137 (0.095)	3.901** (1.647)	6.314** (3.171)	3.115** (1.389)	0.141 (0.129)	0.624 (1.333)	0.279 (2.660)	0.952 (1.291)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	0.108	6.289	8.668	4.900	0.144	6.186	8.135	5.557
Observations	530	533	533	533	435	427	427	427

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

	Herd size (CMVE)	Total household cash earning (USD)	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)
Any insurance purchased (in six sales seasons)	2.580 (9.441)	23.284 (244.235)	0.217* (0.114)
Controls	✓	✓	✓
Control mean	14.007	512.759	0.112
Observations	1179	1179	762

Robustness: Education sample only - herd size, cash earnings, education

	Herd size (CMVE)	Total household cash earning (USD)	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)
Any insurance purchased	-10.341 (10.386)	47.319 (261.958)	0.168** (0.084)
Controls	✓	✓	✓
Control mean	15.442	541.409	0.121
Observations	762	762	762

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	352.660 (519.093)	313.145 (310.904)	67.790 (158.605)	-20.556 (37.165)	51.142 (35.010)	-39.456 (97.891)	48.641*** (17.186)	4.041 (29.899)	-11.043 (8.964)	-46.675 (204.839)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	1082.818	84.062	275.816	45.156	28.629	134.929	10.346	15.679	2.835	485.365
Observations	1179	1179	1179	1179	1179	1179	1179	1179	1179	1179

Effects on income – extensive margin

	= 1 if the outcome > 0									
	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	0.083 (0.054)	0.054 (0.115)	0.082 (0.114)	-0.078 (0.122)	-0.065 (0.089)	0.107 (0.120)	0.069 (0.079)	0.018 (0.067)	0.033 (0.058)	0.056 (0.098)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control mean	0.956	0.224	0.517	0.384	0.151	0.723	0.075	0.063	0.034	0.881
Observations	1179	1179	1179	1179	1179	1179	1179	1179	1179	1179

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	367.836 (447.053)	53.291 (35.081)	0.072 (0.111)	0.090 (0.087)
Controls	✓	✓	✓	✓
Control mean	568.593	26.026	0.798	0.117
Observations	1179	1179	1179	1179

Heterogeneous effects by country: Herd size, cash earnings, education

	Herd size (CMVE)	Total household cash earning (USD)	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)
Any insurance purchase (β_{LATE})	5.260 (9.014)	-94.968 (235.571)	0.120 (0.088)
Any insurance purchase \times Ethiopia (β_{Hetero})	-12.382 (29.476)	627.643 (550.229)	0.330 (0.349)
Coef: $\beta_{LATE} + \beta_{Hetero}$ (Ethiopia)	-7.122	532.675	0.450
p-val: $\beta_{LATE} + \beta_{Hetero}$ (Ethiopia)	0.802	0.276	0.174
Controls	✓	✓	✓
Control mean	14.265	529.673	0.115
Observations	1179	1179	762

Heterogeneous effects by initial herd tercile: Herd size, cash earnings, education

	Herd size (CMVE)	Total household cash earning (USD)	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)
Any insurance purchase (β_{LATE})	8.728 (8.244)	-42.958 (468.805)	0.248 (0.183)
Any insurance purchase \times 2nd tercile (β_{Hetero}^{2nd})	5.894 (19.336)	197.452 (541.134)	-0.167 (0.216)
Any insurance purchase \times 3rd tercile (β_{Hetero}^{3rd})	-21.174 (22.888)	-58.977 (623.532)	-0.032 (0.251)
Coef: $\beta_{LATE} + \beta_{Hetero}^{2nd}$ (2nd tercile)	14.622	154.495	0.082
p-val: $\beta_{LATE} + \beta_{Hetero}^{2nd}$ (2nd tercile)	0.399	0.554	0.507
Coef: $\beta_{LATE} + \beta_{Hetero}^{3rd}$ (3rd tercile)	-12.447	-101.935	0.216
p-val: $\beta_{LATE} + \beta_{Hetero}^{3rd}$ (3rd tercile)	0.503	0.793	0.183
Controls	✓	✓	✓
Control mean	14.265	529.673	0.115
Observations	1179	1179	762

Heterogeneous effects by gender of the household head: Herd size, cash earnings, education

	Herd size (CMVE)	Total household cash earning (USD)	Share of members who completed age-appropriate years of education
	(1)	(2)	(3)
Any insurance purchase (β_{LATE})	0.222 (11.026)	3.210 (244.001)	0.095 (0.086)
Any insurance purchase \times Female head (β_{Hetero})	15.849 (19.811)	11.829 (569.391)	0.596 (0.510)
Coef: $\beta_{LATE} + \beta_{Hetero}$ (Female head)	16.072	15.039	0.691
p-val: $\beta_{LATE} + \beta_{Hetero}$ (Female head)	0.282	0.976	0.171
Controls	✓	✓	✓
Control mean	14.265	529.673	0.115
Observations	1179	1179	762

Herd composition – Large vs. Small ruminants

	N of animals (CMVE) / Total herd size (CMVE)	
	Camels and cattle	Goats and sheep
	(1)	(2)
Any insurance purchased	0.230** (0.115)	-0.230** (0.115)
Controls	✓	✓
Control mean	0.596	0.404
Observations	987	987

Number of animals by species

	Number of animals			
	Camel	Cattle	Goats	Sheep
	(1)	(2)	(3)	(4)
Any insurance purchased	0.953 (2.746)	-1.117 (4.879)	-6.401 (7.910)	-3.332 (5.221)
Controls	✓	✓	✓	✓
Control mean	6.471	7.455	23.266	22.666
Observations	1179	1179	1179	1179

Number of animals: Large vs. Small ruminants

	N of animals (CMVE)		Raw N of animals	
	Camels and Cattle	Goats and Sheep	Camels and Cattle	Goats and Sheep
	(1)	(2)	(3)	(4)
Any insurance purchased	0.364 (7.932)	-0.746 (1.402)	-0.311 (6.482)	-6.707 (8.319)
Controls	✓	✓	✓	✓
Control mean	18.134	6.942	13.927	26.684
Observations	1179	1179	1179	1179

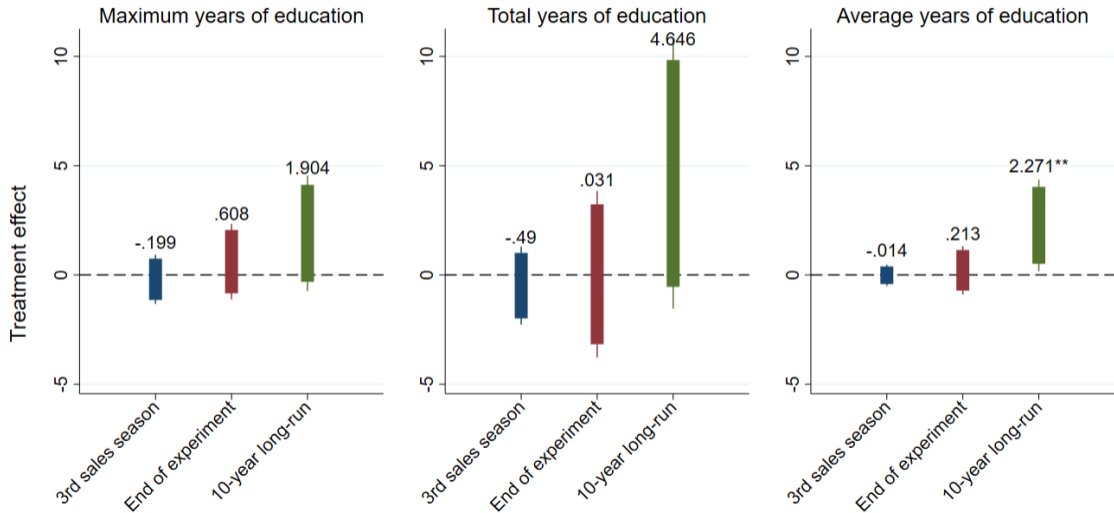
Robustness: Using IBLI uptake and coupon receipts from all six sales seasons

	Outcome: N of animal type in CMVE / Total N of animals in CMVE			
	Camel	Cattle	Goats	Sheep
	(1)	(2)	(3)	(4)
Any insurance purchased (in six sales seasons)	0.149 (0.106)	0.101 (0.097)	-0.271** (0.111)	0.020 (0.058)
Controls	✓	✓	✓	✓
Control mean	0.281	0.292	0.299	0.128
Observations	987	987	987	987

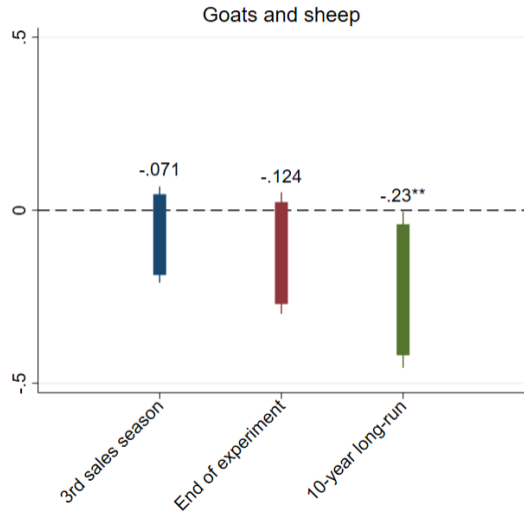
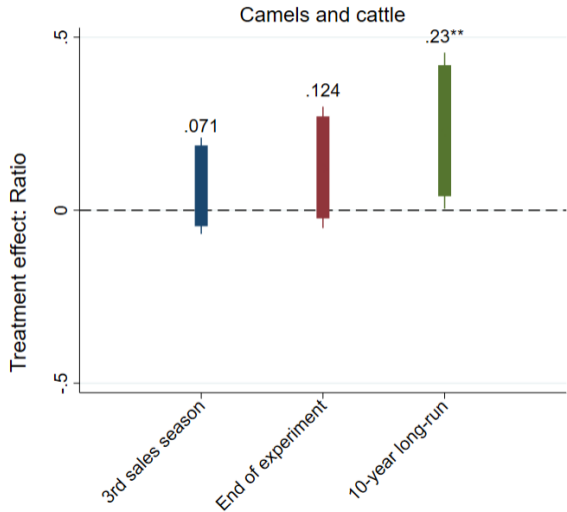
Robustness: Education sample only - Herd composition

	Outcome: N of animal type in CMVE / Total N of animals in CMVE			
	Camel	Cattle	Goats	Sheep
	(1)	(2)	(3)	(4)
Any insurance purchased	0.105 (0.101)	0.087 (0.092)	-0.236** (0.115)	0.050 (0.057)
Controls	✓	✓	✓	✓
Control mean	0.290	0.277	0.304	0.129
Observations	629	629	629	629

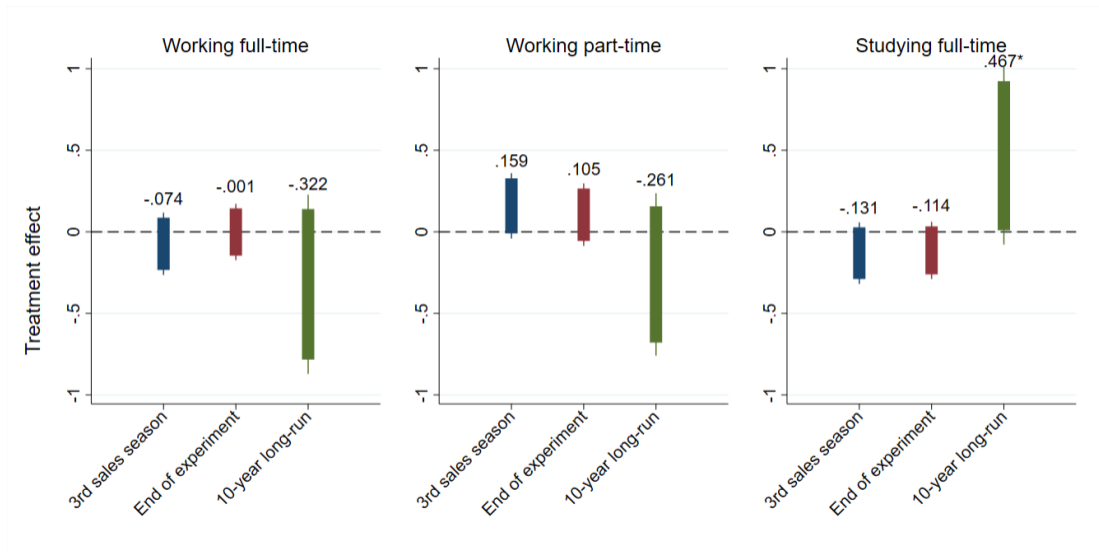
Effects on other measure of educational attainments



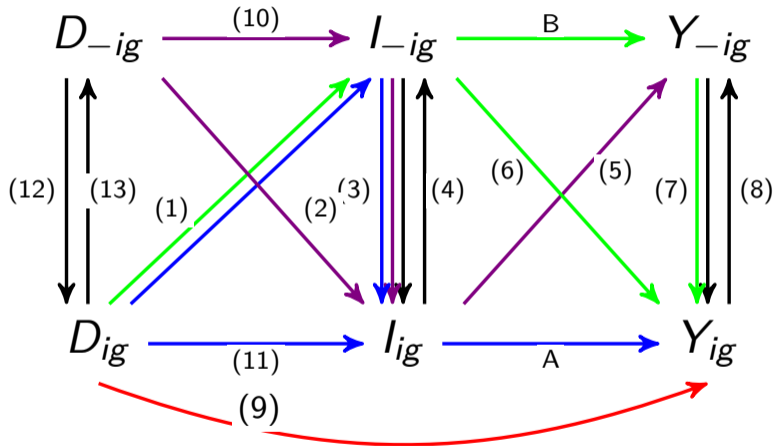
Effects on the share of large vs small animal types over time



Effects on children's work and schooling over time



Potential spillover interactions



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	\bar{D}_{-ij} : Peers'	I_{ij} : Recipient's			\bar{I}_{-ij} : Peers'		
No. of coupons received – first three seasons	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D_{ij} : Recipient's		-0.005 (0.004)	0.117*** (0.017)		0.116*** (0.017)	-0.007 (0.006)		-0.008 (0.006)
\bar{D}_{-ij} : Peers'	-0.225 (0.179)			-0.311** (0.124)	-0.285** (0.123)		-0.182*** (0.040)	-0.184*** (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

Spillover effects on prespecified secondary outcomes

	Herd management expenditure (USD)		Milk Income		Livestock loss (CMVE)		Distress sales (CMVE)		Livestock Sale (CMVE)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
I_{ig} : Any insurance purchase - first three seasons	-53.497 (132.739)	-900.003 (1716.932)	503.728 (474.293)	1704.268 (2662.260)	5.010 (6.518)	2.160 (22.176)	-0.547 (0.702)	-0.480 (0.689)	-0.704 (1.913)	3.209 (10.995)
\hat{I}_{-ig} : Peers' any insurance purchase - first three season	-2348.016 (3375.063)	-32249.646 (60528.703)	5317.075 (7064.740)	48187.755 (91866.056)	132.229 (194.592)	16.786 (749.065)	-6.924 (42.544)	-4.085 (42.494)	15.597 (40.584)	150.792 (378.002)
Recipient controls (i)	✓		✓		✓		✓		✓	
Peers' controls (-i)		✓		✓		✓		✓		✓
Control mean	167.891	167.891	359.879	359.879	5.448	5.448	0.292	0.292	1.872	1.872
Observations	1179	1179	1179	1179	1179	1179	781	781	1179	1179

Spillover effects on IBLI purchase and children's activities

	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)
\hat{l}_{ig} : Any insurance purchase - first three seasons	0.038 (0.071)	0.413 (0.795)	-2.047 (2.052)	-15.792 (30.390)	0.260 (1.005)	1.557 (3.375)	-0.005 (0.774)	0.406 (1.789)	-0.583 (1.591)	0.076 (1.634)
\hat{l}_{-ig} : Peers' any insurance purchase - first three season	0.086 (1.284)	13.421 (27.589)	-45.933 (58.709)	-529.680 (1066.618)	16.261 (32.876)	51.297 (100.274)	7.198 (24.515)	18.935 (53.558)	-29.402 (50.693)	-10.559 (48.448)
Recipient controls (i)	✓		✓		✓		✓		✓	
Peers' controls (-i)		✓		✓		✓		✓		✓
Control mean	0.042	0.042	0.539	0.539	0.271	0.271	0.201	0.201	0.232	0.232
Observations	1179	1179	1179	1179	376	376	376	376	376	376