# Long-run Effects of Catastrophic Drought Insurance*

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December 2025

**Abstract**

We study the long-run effects of catastrophic drought insurance on pastoralist households in Kenya and Ethiopia. Instrumenting with randomized premium discounts, we estimate the impacts of insurance coverage a decade later. Insurance coverage induced households to herd fewer small livestock like goats, typically used as precautionary savings in the short run, an effect which persisted in the long-run. Insurance also generated a significant long-run increase in children's education. These effects are driven by households with small baseline herds, reflecting reduced child labor demand. We provide suggestive evidence that these impacts stem from reduced *ex ante* risk exposure and the behavioral change it induces, rather than from *ex post* indemnity payments.

*Keywords:* Ethiopia, human capital, index insurance, Kenya, livestock, pastoralists

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0*Data were collected by a consortium of the International Livestock Research Institute (ILRI), Cornell University, Syracuse University, the University of California at Davis, the University of Sydney, and the Institute of Developing Economies-JETRO, supported financially by the US Agency for International Development (USAID) Agreement No. LAG-A-00-96-90016-00 through Broadening Access and Strengthening Input Market Systems Collaborative Research Support Program (BASIS AMA CRSP), the Australian Department of Foreign Affairs and Trade through the Australia Development Research Awards Scheme award "The human and environmental impacts of migratory pastoralism in arid and semi-arid East Africa", JSPS Grant-in-Aid for Scientific Research (B)-26301021, the UK Department for

# 1 Introduction

Catastrophic aggregate shocks, such as droughts and other natural disasters, have negative long-run impacts on household welfare, shaping educational attainment, health, asset accumulation, and labor market outcomes (Maccini and Yang, 2009; Dinkelman, 2017; Shah and Steinberg, 2017; Carrillo, 2020). In the absence of well-functioning financial markets, liquidity constraints may force households to adopt costly coping strategies, including the distress sale of productive assets and reductions in human capital investment that are particularly detrimental when experienced early in life (Jensen, 2000; Alderman, Hoddinott, and Kinsey, 2006). Beyond the direct consequences of suffering catastrophic shocks, uninsured risk exposure may induce *ex ante* risk averting behaviors, discouraging investment in high-risk, high-return strategies that promote long-term growth (Boucher, Carter, and Guirkinger, 2008; Karlan et al., 2014; Emerick et al., 2016). In the presence of multiple equilibrium poverty traps uninsured households might not recover if a disaster pushes them into a low-level, poor equilibrium. (Lybbert et al., 2004; Kraay and McKenzie, 2014; Barrett, Carter, and Chavas, 2019). Market failures in insurance provision are widely recognized as a key driver of these adverse effects (Lybbert et al., 2004; Karlan et al., 2014; Barrett, Carter, and Chavas, 2019). While the literature documents positive short-run effects of catastrophic insurance coverage (Karlan et al., 2014; Jensen, Barrett, and Mude, 2017; Hill et al., 2019; Stoeffler et al., 2022; Janzen and Carter, 2019; Castaing and Gazeaud, in press), evidence on long-run impacts remains lacking.

We analyze the immediate and long-run (10-year) effects of catastrophic drought insurance coverage on income, asset holdings, production strategies, and human capital accumulation among pastoralist households in northern Kenya and southern Ethiopia. We find that even temporary insurance coverage induces immediate shifts in production strategies that persist in the long-run. Specifically, insurance causes a short-run reduction in the share and number of small livestock, mainly goats, often held as precautionary savings, driven by households with small baseline herds.

International Development(DfID) through FSD Trust Grant SWD/Weather/43/2009, the Agriculture and Rural Development Sector of the European Union through Grant agreement No: 202619-101, USAID Grant No: EDH-A-00-06-0003-00, the World Bank's Trust Fund for Environmentally and Socially Sustainable Development (Grant No: 7156906), the CGIAR Research Programs on Climate Change, Agriculture and Food Security and Dryland Systems, the CGIAR Standing Panel on Impact Assessment, the CGIAR Research Program on Livestock, and the Foreign, Commonwealth & Development Office Project "Extreme Poverty - Building Evidence for Effective Action" through Oxford Policy Management Limited (Award Number: POR008864). This research was approved by Institutional Review Boards at Cornell University (Protocol ID No 0907000655, 1203002881, 2008009760) ILRI (IRB approval number: ILRI-IREC2015, ILRI-IREC2020-53), and NACOSTI(NACOSTI/P/20/7050). We thank four anonymous reviewers and seminar audiences at Colgate, Cornell, European University Institute, Centre for the Study of African Economies 2024, International Conference of Agricultural Economists 2024, Japanese Association of Development Economics, Kyoto, Oxford Policy Management, UC Davis, UNU-WIDER 2025, Utrecht, Wageningen, and Yonsei, Michael Carter, John McPeak, Travis Lybbert and Dean Yang for helpful comments.

These insured households with small baseline herds also enjoy increased crop income, consistent with sedentarization, income diversification and improved household productivity. In the long run, children's educational attainment rises sharply, driven by reduced holdings of small livestock that lower demand for children's herding labor, similar to Shah and Steinberg (2017) and Bau et al. (2024). These effects do not hold for insured households with large baseline herds, among whom we observe significant increases in large animals herded at endline. We provide suggestive evidence that effects arise from reduced *ex ante* risk exposure rather than *ex post* indemnity payments. These findings highlight insurance's role in mitigating risk-driven under-investment in long-run human capital formation.

The long-run effects of insurance against catastrophic shocks remains understudied, in part because most insurance programs in low-income communities have proved short-lived. Agricultural indemnity insurance is fraught with moral hazard, adverse selection and high transaction costs, while index insurance products have struggled to scale due to low product quality and implementation challenges (Binswanger-Mkhize, 2012; Mobarak and Rosenzweig, 2013; Carter et al., 2017; Jensen and Barrett, 2017; Hill et al., 2019). Index-Based Livestock Insurance (IBLI) is a notable exception (Jensen et al., 2025).[1] IBLI relies on a satellite-based Normalized Difference Vegetation Index (NDVI) indicator of relative forage scarcity – specifically designed to minimize basis risk in this system – to insure against catastrophic herd losses associated with droughts (Chantarat et al., 2013). Since piloting in northern Kenya in 2010, IBLI gradually expanded to over 560,000 households in three countries: Ethiopia, Kenya, and Zambia (Jensen et al., 2024b). Recent initiatives by the governments of Kenya, Ethiopia, Djibouti and Somalia, supported by the World Bank, have scaled IBLI to 3.2 million pastoralists (The World Bank, 2022).[2,3] IBLI's decade-plus persistence and the experimental design of its pilot permits assessment of the long-run impacts of insurance against catastrophic droughts.

We conduct a 10-year follow-up panel survey with the original baseline sample of pastoral households from Kenya (in 2009) and Ethiopia (in 2012). We leverage the household-level randomized distribution of insurance premium subsidies – that happened immediately after the baseline – to 1,439 pastoralists from 33 locations. In each location, a random sample of households was randomly assigned to receive premium discount coupons that were distributed just prior to each of six sales seasons between 2010 and 2015. The coupons were non-transferable, expired at the end of the sales season, and were re-randomized each sales season. The coupons provided households with a discount on the insurance premium for a maximum of 15 Tropical Livestock Units

[1] Unlike most agricultural index insurance products, which insure against low annual crop yield realizations, IBLI insures against the loss of durable assets, in this case livestock, like most commercial insurance products worldwide.

[2] https://www.financialprotectionforum.org/blog/pilot-scale-how-research-powers-pastoralists-progress

[3] IBLI also underpins macro-scale sovereign drought insurance in Kenya and Mauritania; see Jensen et al. (2024b).

(TLUs).[4] The same households were then surveyed annually for three rounds in Ethiopia and five rounds in Kenya, up to 2015.[5] From 2009-2015, low NDVI readings triggered the drought index four times in Kenya and once in Ethiopia, resulting in indemnity payments to policyholders. No randomized premium discounts were provided nor any surveys were conducted after 2015, until we conducted the 10-year follow-up survey with original panel households in 2020 in Kenya and in 2022 in Ethiopia. The study communities largely lacked access to IBLI after the research team ceased last-mile extension support (Jensen et al., 2024a).[6]

We leverage randomized insurance premium discounts distributed during the initial years of IBLI to estimate the Local Average Treatment Effect (LATE) of insurance purchase on pre-specified outcomes.[7] We instrument for insurance purchase using the number of discount coupons received in the first three sales seasons.[8] Our pre-specified primary outcomes are assets (i.e., herd size), total cash income, production strategies (i.e., herd composition), and human capital accumulation (i.e., maximum education level of household members). Our pre-specified secondary outcomes are recent insurance uptake and short-run impacts observed immediately after the experiment period: herd management expenditures, annual milk income (cash only), livestock loss, distress sale of livestock, and the share of children working and studying full-time.

The long-run effects of catastrophic drought insurance are striking. We observe a sharp shift in herd composition – a 48 percent reduction in the share of small animals herded and (by construction) a corresponding increase in the share of larger animals herded, significant at the ten percent level. These overall effects on herd composition mask important heterogeneity by baseline herd size. For the two-thirds of households with less than 20 TLUs at baseline,[9] we observe a significant 26 animal decrease in the number of small ruminants (i.e., goats or sheep), relative to a control mean of 39, a 67% decrease. As discussed below, these effects materialized immediately after insurance uptake. For the one-third of households with more than 20 TLUs at baseline we observe

[4]Tropical Livestock Unit (TLU) is an integrated unit for aggregating cattle, camel, sheep, and goats by typical live body weight and basal metabolic nutrient intake requirements. 1 TLU = 0.7 Camel = 1 Cattle = 10 Sheep/goats.

[5]We did not collect data in Kenya in 2014.

[6]The research team had provided the last mile marketing and outreach for the commercial underwriters during the 2010-15 period, including providing transport to the 33 study locations for insurance sales agents. When the field research ended after the 2015 survey rounds, the insurers had specialized in supplying other areas, and did not reliably offer IBLI in our study villages, even as they continued to sell IBLI in other villages where the insurers had arranged and financed the last mile sales and outreach from 2010-15. Thus while IBLI has continued, even expanded overall outside our study villages since the study period, in our study villages sales paused. IBLI was effectively a temporary intervention in these 33 villages prior to our 10-year follow up visits.

[7]See AEARCTR-0011184 at https://www.socialscienceregistry.org/trials/11184. The pre-analysis plan was submitted after data collection of the 2020 and 2022 endline data, but before data analyses of the endline data happened.

[8]This strong instrument has a monotonic relationship with the endogenous regressor. Several robustness tests, using alternative instruments and endogenous regressors yield qualitatively similar results (Appendix Tables E6-E22).

[9]Appendix Figure H1 presents histograms of total livestock and by species at baseline.

a significant increase of 14 large animals (i.e., cattle or camels), relative to a control mean of 7 in the control group, a 200% increase. While total cash income does not change significantly, we find significant increases in in-kind crop income, driven by the two-thirds of households with small herds, suggesting improved household productivity. Furthermore, we find significant increases of 40%-55% relative to the control group in the maximum, total and average education of household members who were school-aged (aged 6-18 years in Kenya, 7-19 in Ethiopia) during the experiment. The education results are entirely driven by the two-thirds of households with $\leq 20$ TLUs at baseline, the same households who sharply reduced smallstock holdings and increased crop income. The share of children currently working, either full-time or part-time, falls from 55.3% among control households to 0.3% among insured households ($p$-value 0.104), with the share of children studying full time more than tripling, from about 16% in the control group to 58% for insured households. These sizeable effects follow directly from the exceptionally low baseline rate of full-time school attendance and educational attainment among this subpopulation.

The long-run effects appear attributable mainly to *ex ante* behavioral effects induced by insurance coverage that reduces catastrophic risk exposure, and not by the *ex post* impacts of the large cash transfers that insured households received as indemnity payments triggered by (exogenous) low NDVI readings during droughts. This is consistent with prior findings of subjective well-being gains from insurance coverage even in the absence of payouts (Tafere, Barrett, and Lentz, 2019), as well as *ex ante* effects of insurance on increases in productivity, irrespective of indemnity payments (Karlan et al., 2014; Cole and Xiong, 2017; Jensen, Barrett, and Mude, 2017; Hill et al., 2019; Matsuda, Takahashi, and Ikegami, 2019; Boucher et al., 2021; Stoeffler et al., 2022; Son, 2025).

Several short-run effects that were identified during and immediately after the IBLI experiment period (Jensen, Barrett, and Mude, 2017; Janzen and Carter, 2019; Matsuda, Takahashi, and Ikegami, 2019; Noritomo and Takahashi, 2020) – on total herd size, herd management expenditures, livestock loss, and distress sales of livestock – are not observed at this longer-run horizon. We also do not find a significant long-run effect of insurance on recent insurance uptake in the 12 months before the endline, consistent with the observation that the commercial insurers stopped supplying the insurance in our study villages when the research team stopped supporting last mile logistics in 2015 (Jensen et al., 2024a).

Beyond a range of standard checks for alternative IV specifications, clustering, multiple hypothesis testing, randomization inference and controls, we also investigate the robustness of our results to potential interpersonal spillovers. In the original experiment, households within communities were randomized to either receive discount coupons or not. Spillovers in the first- and second-stage of our IV strategy – for example through informal risk-sharing arrangements between treated

and untreated individuals – may violate the Stable Unit Treatment Values Assumption (SUTVA) and/or the exclusion restriction on which causal identification relies. We leverage exogenous variation across communities in discount coupons received by peers to estimate potential spillovers in our first- and second-stage IV estimation. The key outcomes on education, herd composition and whether or not children work or study full-time remain robust to controlling for potential interpersonal spillovers, although the results on studying and working become less precisely estimated.

Although it may seem surprising that temporary insurance uptake has such long-run consequences, these resulted from herd composition changes that materialized immediately after the experiment – when households were covered by insurance – and continued thereafter. Our interpretation is that temporary insurance coverage induced herd portfolio shifts that increased household productivity, consistent with the immediate increase in crop income. This increased productivity allowed these changes to grow over time. The effect on the share and number of small animals owned among the two-third of households with small herds at baseline may have arisen due to a reduced need for holding precautionary savings. Goats are often referred to as "cash with four legs," a highly liquid, non-lumpy asset, with an average value of roughly USD 10, commonly sold to cover modest expenses (McPeak, Little, and Doss, 2011).[10] The effect on the one-third of households with large herds at baseline, which demonstrate a long-run increase in large animals herded, may have been driven by incentives to invest in higher-risk but higher-return species, which camel and cattle represent. The fact that our results are driven by a reduction in *ex ante* risk exposure is consistent with this interpretation.[11]

The herd composition and education results, both driven by households with small baseline herd sizes, are substantively linked. Fewer small animals to herd lowered household demand for child labor because children mainly herd smallstock like goats, rarely camels or cattle. The herd reduction, concentrated among the species children are most likely to herd, increased incentives to educate children. But those outcomes take time to materialize. Hence, we do not observe the education results immediately after the experiment, but they appear at the 10-year follow-up.

The results are consistent with the existence of multiple equilibrium poverty traps that have been previously documented in this and similar contexts (Lybbert et al., 2004; Barrett et al., 2006; Santos and Barrett, 2011; Kraay and McKenzie, 2014; Barrett, Garg, and McBride, 2016; Santos and Barrett, 2019; Banerjee et al., 2019; Barrett, Carter, and Chavas, 2019; Balboni et al., 2022). We observe accumulation of large animals by households with initial herd sizes above the 20 TLU

[10] Given average insurance purchase volumes, we can rule out that the sale of goats to pay for insurance premiums explains any more than a very small ($\sim 10\%$) of the estimated effect.

[11] Herd portfolio change suggests that by temporarily reducing risk exposure, insurance facilitated transition from a more liquid, lower-productivity herd portfolio to a higher-productivity but less liquid one.

threshold identified in prior studies in this area as the point at which household behavioral and wealth dynamics bifurcate (Lybbert et al., 2004; Barrett et al., 2006; Santos and Barrett, 2011; Santos and Barrett, 2019), while below that threshold we see households shed smallstock held as precautionary savings by less well-off pastoralists (McPeak and Barrett, 2001; McPeak, 2005; McPeak, Little, and Doss, 2011). Such bifurcated herd dynamics are precisely what one would expect from even transitory exposure to insurance and should not occur in the absence of multiple equilibria (Santos and Barrett, 2011; Janzen and Carter, 2019). When insurance launched, few productive livelihood strategies existed in this setting apart from livestock production (Little et al., 2008; McPeak, Little, and Doss, 2011). Our findings that households with small baseline herds divest from smallstock and send their children to school is consistent with the emergence of labor markets for educated workers as an alternate long-run livelihood strategy.[12]

We also build on the literature on the long-run impacts of uninsured exposure to covariate extreme weather shocks, which routinely finds negative effects on education (Maccini and Yang, 2009; Shah and Steinberg, 2017; Carrillo, 2020; Bau et al., 2024), health (Maccini and Yang, 2009; Dinkelman, 2017; Carrillo, 2020), assets (Maccini and Yang, 2009), and labor market outcomes (Carrillo, 2020). We show that insurance against catastrophic shocks can facilitate investment in human capital, especially through reducing *ex ante* risk exposure and costly risk management behaviors such as precautionary savings. Our results are most consistent with an interpretation akin to Shah and Steinberg (2017) and Bau et al. (2024), where insurance against catastrophic shocks, by changing production strategies, indirectly alters the marginal productivity of child labor, changing incentives for children to attend school.

We also connect to the literature on the long-run impacts of development interventions (see Bouguen et al. (2019) for a review). Human capital interventions appear particularly effective at boosting long-run economic outcomes (Hoddinott et al., 2008; Banerjee, Duflo, and Kremer, 2016; Baird et al., 2016; Bandiera et al., 2017; Charpak et al., 2017; Barham, Macours, and Maluccio, 2017; Bettinger et al., 2018; Blattman, Fiala, and Martinez, 2020; Gray-Lobe, Pathak, and Walters, 2023). Studies of unconditional cash transfers and grant assistance consistently find large short-run effects, particularly on asset accumulation, that dissipate over time (Araujo, Bosch, and Schady, 2017; Baird, McIntosh, and Özler, 2019; Blattman, Dercon, and Franklin, 2022; Blattman, Fiala, and Martinez, 2020). We bridge these two literatures by demonstrating the long-run importance of risk mitigation for human capital formation in this setting.

[12] As all-season, paved roads and mobile telephones have penetrated the study area, we have heard pastoralists speak of labor markets for educated workers as an alternate way (than holding large herds) to escape persistent poverty.

# 2 Context and Index-Based Livestock Insurance

The population in the ASALs in northern Kenya and southern Ethiopia heavily depends on extensive livestock grazing - pastoralism - as the most productive livelihood strategy in the drylands (Little et al., 2008; McPeak, Little, and Doss, 2011; Jensen et al., 2024b). Households herd large animals (camels and cattle) and small animals (goats and sheep), and herd composition varies with the aridity of the location. In our sample at baseline, the average herd size was equivalent to 23 cattle,[13] 43% in cattle, 33% goats or sheep and 23% camels. These animals play different roles in the productive strategies of households. Large animals are lumpy assets with values of USD 120-250 each. They are typically seen as investments yielding high milk production, more valuable offspring, and greater social status. Small animals are sometimes referred to as "cash with four legs," a highly liquid, non-lumpy asset, with an average value of roughly USD 10 at baseline, which serve the purpose of providing households with liquidity in these contexts where access to banks or mobile money is still limited (McPeak, Little, and Doss, 2011).

The annual nominal cash income of our survey households is similar at baseline and endline, roughly USD 1.3-1.5 per day, implying a substantial reduction in real cash income from baseline to endline.[14] Over time, households substantially increase the share of cash income invested in herd management, specifically fodder, water, and veterinary expenditures, from about 10% at baseline to 25% at endline. Investing in veterinary services is an effective strategy for reducing livestock mortality and for maintaining lactation rates, especially for large animals (Admassu et al., 2005; Homewood et al., 2006; Sieff, 1999; Santos and Barrett, 2011).

Only 10% to 15% of surveyed household heads ever went to school; the average completed education is approximately one year. Investments in education have, however, increased substantially over time. At baseline, 48.7% of children aged 5-17 were enrolled in school; that increased to 61.3% at endline. Education outcomes are closely linked to households' productive strategies.

[13] Hereafter we use cattle market value equivalents (CMVE) instead of TLU measures. We favor aggregation based on market value rather than on biophysical (i.e., nutrient intake) requirements, which is the basis for TLU because our interest is in total herd size or herd size composition as a productive asset or as a store of wealth. CMVE uses average sales prices by species in the 2010-22 survey data to establish species' relative average value. The average market values from our sales and purchases data are presented in Online Appendix Table H1. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep. CMVE is strongly, positively correlated with TLU; the two measures just aggregate across species using different weighting schemes. All of our results are qualitatively invariant to the use of CMVE versus TLU.

[14] The endline-to-baseline cash income ratio is 531.70/498.44 = 1.07, the endline-to-baseline total income rate is 1114.45/1299.74 = 0.857, while the endline-to-baseline CPI ratio is 2.08 in Kenya and 2.99 in Ethiopia. Total income includes the value of in-kind livestock and in-kind crop income, which is more than double cash income in these settings. See Appendix Tables G1 and G2. Our total income estimates ignore prospective growth in the metabolic mass of livestock, which might occur with changing herd demographic profiles if distress sales fall (Janzen and Carter, 2019), although we suspect such effects, if any, are small.

Children aged 5-17 commonly help with herding, especially of small animals when not studying full-time. At baseline, 40% of school-aged children worked full-time, 28% part-time. At endline in Ethiopia,[15] the share of children working full-time fell from 47 to 28%, and the share of part-time working children decreased from 26 to 18%.

The pastoral households in our sample are vulnerable to catastrophic drought shocks. Drought-related starvation, dehydration and disease account for 47 percent of livestock losses in the region (Jensen, Barrett, and Mude, 2016). Following droughts, pastoralists rebuild herds slowly, relying largely on biological reproduction supported by complex systems of inter-household livestock gifts and loans (McPeak and Barrett, 2001; Lybbert et al., 2004; Little et al., 2008; McPeak, Little, and Doss, 2011; Takahashi, Barrett, and Ikegami, 2019).

Informal insurance networks have, however, been fraying in the region, in part because of seemingly more frequent and severe droughts that affect all households simultaneously (McPeak, Little, and Doss, 2011; Huysentruyt, Barrett, and McPeak, 2009). This also implies that many herders concurrently seek to sell livestock with declining weight and productivity – which affect animals' value – thus livestock markets offer little income or wealth stabilization against drought shocks (Barrett et al., 2003). Prior to IBLI, financial services were largely unavailable in these areas (McPeak, Little, and Doss, 2011). As a result, herd accumulation has long been the key risk management strategy to help households rebuild assets after catastrophic shocks, for the simple reason that greater pre-drought herd size is strongly associated with increased post-drought herd size (Lybbert et al., 2004; McPeak, 2005; Barrett and Swallow, 2006; Cissé and Barrett, 2018).

IBLI offers a novel means to manage catastrophic drought risk. Forage availability offers a key signal of drought in rangelands. So IBLI was designed around near-real-time measures of the Normalized Difference Vegetation Index (NDVI), a reliable signal of forage availability (Meroni et al., 2014; Prince, 1991; Tucker et al., 1985) and shown to be strongly correlated with livestock mortality in this region (Chantarat et al., 2013). NDVI is generated and provided freely every ten days by the United States Geological Survey from satellite data. IBLI uses an index that aggregates NDVI data within geographically defined units in each of two annual seasons that characterize the region's bimodal annual rainfall pattern. Historic NDVI data for each insurance unit were used to develop a statistical distribution of outcomes. Insurers and reinsurers used those estimates to negotiate a strike level below which indemnity payments would be made (Chantarat et al., 2013; Vrieling et al., 2016). While the specifics of the IBLI policy and the index that underpins it have evolved somewhat over time and differ slightly between the Ethiopia and Kenya sites, the core is uniform.[16]

[15] Comparable enrollment data were not collected at endline in Kenya.

[16] See Jensen et al. (2024b) for richer details on the background, design, history and impacts of IBLI.

IBLI piloted in Marsabit County, in northern Kenya, in January 2010 as a purely commercial index insurance product sold directly to individual pastoral households. A similar product was introduced in the neighboring Borana region of southern Ethiopia in August 2012. Towards the end of our experiment, in 2015, the Government of Kenya added IBLI to its social protection programming by launching the Kenya Livestock Insurance Program (KLIP), which used public resources to purchase individual IBLI policies on behalf of vulnerable pastoralists. In Borana, commercial sales were sustained at the same or higher volumes after the original pilot ended. Despite the scaling of the programme outside of our study locations (Jensen et al., 2024a), as the research team ceased providing last mile extension and logistics in 2015, with insurance companies focused on new areas (where growth rates from premium income were higher), IBLI supply in our study locations effectively stopped.

# 3 Study design and econometric strategy

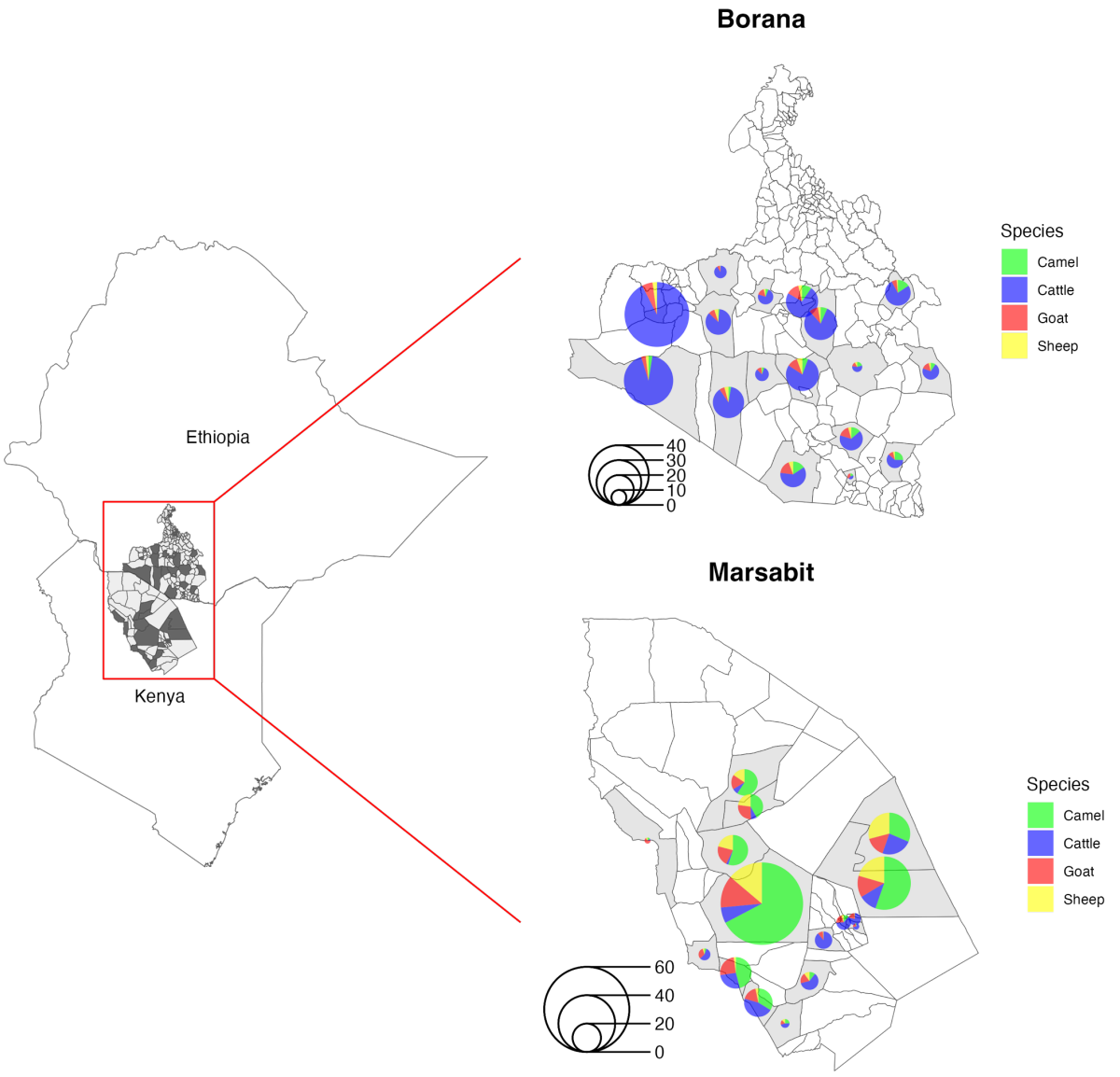
To study the long-run effects of catastrophic drought insurance, we leverage the original experimental design of seasonally randomized insurance premium discount coupons to 1,439 pastoralists from 17 locations in Borana Zone in Ethiopia and 16 locations in Marsabit County in Kenya. The 33 study locations were selected strategically to ensure representation across environmental conditions and remoteness. Community entry meetings with local leaders were the first point of contact between the research teams and the locations. During these meetings, the project was broadly described and community household rosters were collected from government administrative offices. These took place before any field activities by the insurance firms or their agents.

Household selection for participation in the experiment was based on a random sample, stratified by herd size strata, which is one of the most important predictors of resilience against shocks (Cissé and Barrett, 2018). The selected households were then randomly assigned to receive discount coupons or not each IBLI sales period, with the likelihood of treatment constant across locations. This resulted in 924 households sampled in Kenya, and 515 households in Ethiopia. Figure 1 maps the study locations and the herd (size) distributions per location.

Baseline household surveys took place in Kenya in the fourth quarter of 2009 and in Ethiopia in the first quarter of 2012, before IBLI's launch was announced in either country. The surveys captured a range of household demographic and economic data.[17] IBLI launched with the first follow-up survey after the baseline in each location. Panel surveys tracked the same households

[17] Additional details on the research design, sample, survey tools and discount coupons are on ILRI's data portal: https://data.ilri.org/portal/dataset/ibli-marsabit-r1 and https://data.mel.cgiar.org/dataset.xhtml?persistentId=hdl:20.500.11766.1/FK2/S19DC6 for Kenya and https://data.ilri.org/portal/dataset/ibli-borena-r1 for Ethiopia.

Figure 1: Map of study locations and herd (size) distributions per location




Notes: Geographic distribution, herd size and herd composition in Marsabit County, Kenya, and Borana Zone, Ethiopia. The map illustrates the spatial variation and proportional distribution of livestock (e.g., cattle, camel, goats and sheep) across administrative units (i.e., sublocations in Kenya and kebeles in Ethiopia). The pie sizes are proportional to total herd size (in TLU) in each of the 33 study locations. Green, blue, red and yellow represent the average herd share of camels, cattle, goats, and sheep, respectively.

annually for three rounds in Ethiopia and five rounds in Kenya, until 2015. Individual households were randomly assigned to receive premium subsidies through discount coupons that were distributed directly to respondents just prior to a sales season. These randomized discount coupons were non-transferable, expired at the end of the sales season, and were re-randomized in each of

six sales seasons between 2010 and 2015. There was no refusal of the discount coupons. Per community and sales season, 60-80% of the sample households received discount coupons. The coupons provided households with a discount on the insurance premium for a maximum of 15 TLUs. During the experiment, low NDVI readings arising from drought triggered the index four times in Kenya and one time in Ethiopia, resulting in indemnity payments. Administrative data are used to track purchases.

No surveys nor experiments were conducted in these sites after 2015 until we conducted follow-up surveys in both countries with original panel households in 2020 in Kenya and in 2022 in Ethiopia, ten years after the original baselines. Figure 2 shows the timeline of the original pilots, discount coupon treatments, as well as the timing of the latest rounds of surveys in each country. Of the 1,439 baseline households, we managed to re-survey 82 percent ten years later, a high retention rate given average annual attrition rates of 7.5 percent in panel surveys in other settings (Molina-Millán and Macours, 2025)

Equation (1) offers a general Analysis of Covariance (ANCOVA) representation of how we model the long-run impacts of past and current insurance purchases, where $y_{ijt}$ is outcome $y$ for individual $i$, who lives in location $j$,[18] $t = 0$ refers to the baseline period, before any insurance was sold in location $j$, $t = 1$ refers to the first period when insurance was sold in location $j$, and $t = T$ is the final survey period, ten years after baseline. $I_{ij1}$ refers to insurance purchase by $i$ in the first sales period. $X_{ij0}$ reflects a vector of baseline household characteristics, and $D_{ij}$ is the number of sales seasons during which the household received randomized insurance premium discount coupons.

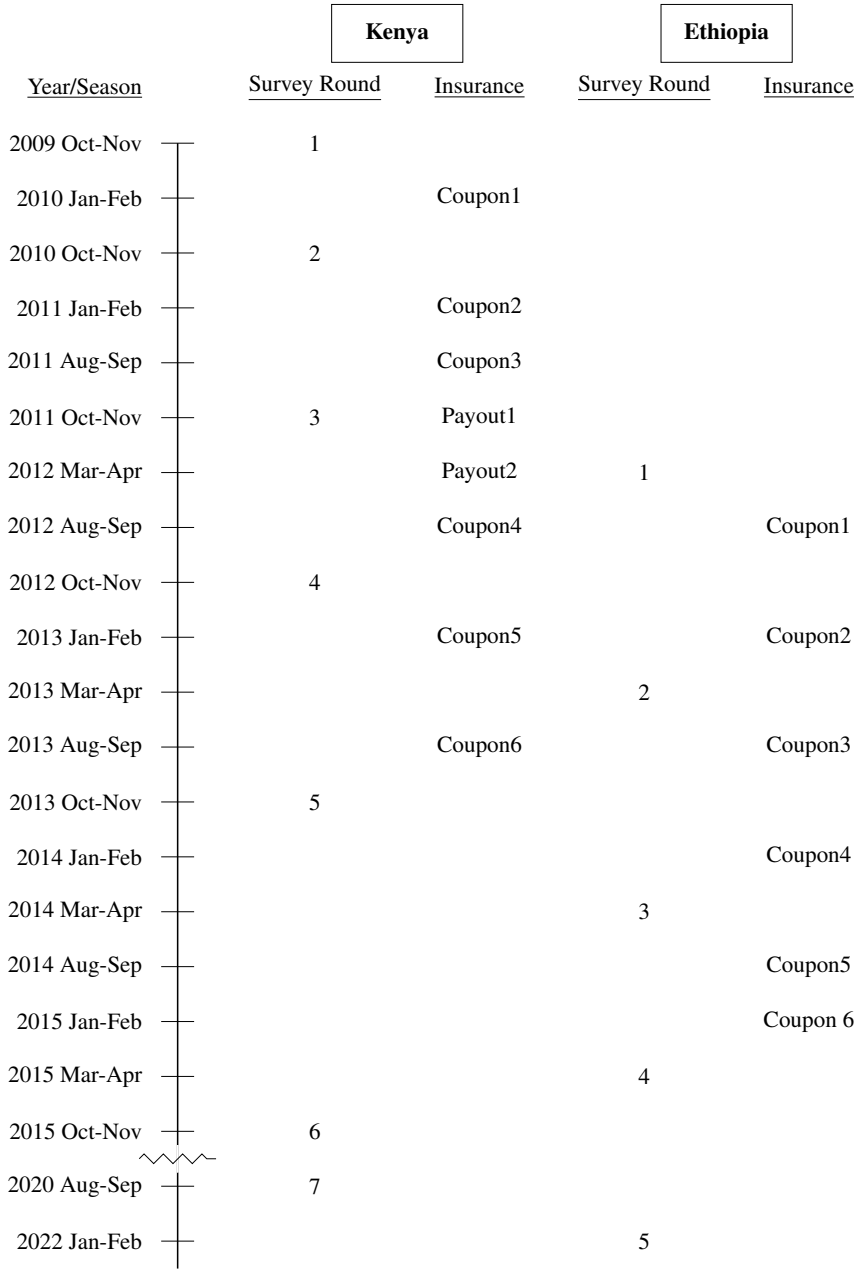
$$y_{ijT} = f(I_{ij1}, ..., I_{ijT}, y_{ij0}, X_{ij0}, D_{ij}) \tag{1}$$

We estimate the LATE of insurance purchase for our pre-specified outcomes, instrumenting for insurance purchase by the number of seasons in which the pastoralist received a discount coupon. As pre-specified, we restrict the analysis to discount coupons and insurance purchases in the first three sales seasons, as this provides a strong instrument (see Section 5). We show robustness of our results to alternative specifications of the instrument and endogenous regressor in Appendix Tables E6 - E22. This approach does not, therefore, identify the effect of any changes in behavior caused by randomized discount coupons in sales seasons 4 to 6, for which we control. We discuss these dynamics and potential mechanisms driving long-run impacts in Section 7.

Equations (2) to (5) describe the outcome and IV equations. We use an ANCOVA specification to estimate the LATE of insurance purchase on long-run outcome $y$ in Equation (2), instrumenting

[18]Location refers to 16 sublocations in Kenya and 17 kebeles in Ethiopia. Locations are nested within distinct index insurance units within which the NDVI-based index determines whether an indemnity payment occurs.

Figure 2: Panel Timeline




*Notes*: The figure presents the timeline of the panel survey and experiment in Kenya and Ethiopia. The column "Survey Round" refers to each round of the panel survey from 1 to 7 in Kenya and 1 to 5 in Ethiopia. The column "Insurance" refers to the events related to index-based livestock insurance where Coupon1-Coupon6 refers to the rounds where discount coupons were randomly assigned to recipients, and re-randomized every round. The discount coupons provided discounts on the insurance premium for purchase of coverage over a period of 12 months. The product was sold over two periods occurring directly before the two rainy seasons (August-September and January-February) with insurance coverage periods lasting one year. Note that there was no sales window in Kenya in August/September 2010 or January/February 2013. Payout1 and Payout 2 refer to indemnity payments made to (some) recipients in the survey communities during the pilot period (i.e., through 2015).

for any insurance purchase using the number of discount coupons received by households in the first three sales seasons, from Equation (3). Equation (4) generates a binary variable that takes the value one if individual $i$ purchased insurance during any of the first three sales seasons. Equation (5) aggregates the number of discount coupons received ($D_{ijt}$) by an individual household $i$ in location $j$ in sales period $t$ over the first three seasons ($t = 1,2,3$), yielding our instrument ($D_{ij}$). We control for the number of discount coupons received in sales seasons 4, 5, and 6 ($D_{ij4}^{t=6}$).

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

$$I_{ij} = \alpha_1 D_{ij} + \alpha_2 y_{ij0} + \alpha_3 X_{ij0} + \alpha_4 D_{ij4}^{t=6} + \rho_j + \mu_{ij} \tag{3}$$

$$I_{ij} = \begin{cases} 1 \text{ if there exists } t \in \{1,2,3\} \text{ such that } I_{ijt} > 0 \\ 0 \text{ otherwise} \end{cases} \tag{4}$$

$$D_{ij} = \sum_{t=1}^{3} D_{ijt} \tag{5}$$

We include location fixed effects to control for time-invariant, location-level unobservables. Because households rarely migrate alone and typically travel with community members from their same location, location fixed effects effectively control for effects at broader grazing ranges that are episodically used by the households in each community $j$ (McPeak, Little, and Doss, 2011; Huysentruyt, Barrett, and McPeak, 2009). Given that the likelihood of treatment among selected households is fixed, and we randomize at the household-level, we estimate robust standard errors following Abadie et al. (2022) and De Chaisemartin and Ramirez-Cuellar (2024). Our results are, however, robust to clustering standard errors at the community level instead.

# 4 Balance and Attrition

Table 1 presents the mean and standard deviation of pre-specified balance variables, and baseline values of our pre-specified primary and secondary outcomes in each country and pooled, for the non-attrited sample of households (see below for attrition analysis).[19] We do not observe any significant imbalance per round per pre-specified balance variable, by whether a household received

[19] Appendix Table C1 presents the endline values of our pre-specified primary and secondary outcomes.

a coupon or not, and normalized differences are below the threshold of 0.25 in 46 out of 48 tests (Appendix Table A1). F-statistics for joint significance of all variables per round are insignificant as are F-statistics for joint significance of one variable across all rounds.

During the period of the experiment, coupons were offered six times, once or twice per year. Given that the product provides coverage for one year, the equivalent of continued insurance coverage during the experimental period in Kenya would have been purchase of insurance three times, while in Ethiopia the equivalent of full insurance coverage during the experimental period would have been purchase of insurance 2.5 times. 29% of respondents purchased insurance once, and 22% of respondents purchased insurance more than once. The left panel of Figure 3 shows the distribution of the number of sales seasons in which pastoralists received discount coupons. On average, they received coupons 4.07 times. The right panel of Figure 3 shows the cumulative number of policies sold, by season. Cumulative uptake of insurance increased steadily during the six sales seasons, but 83 percent of ever-purchased households took up the insurance within the initial three sales seasons. We therefore pre-specified use of the three initial sales seasons of insurance uptake and discount coupon receipts to identify the causal effects of insurance on our pre-specified primary and secondary outcomes, not the full six sales seasons.[20]

At the 10-year follow-up, we successfully re-interviewed 82 percent of the baseline households (1,179 out of 1,439 – Appendix Table A2). Attrition is not differential by our instrument, the number of coupons received during the initial three seasons, as shown in Appendix Table A3. 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 (see Appendix Table A4).[21]

# 5 Results

We first examine the effect of randomized discount coupons on insurance purchase, the first stage of our IV strategy. Figure 4 presents the correlation between the number of times that a pastoral household received coupons during the six experimental rounds and the average number of seasons they purchased insurance.

[20] 50 households (4.2 percent of the sample) purchased insurance before they received any discount coupons. Out of those 50 households, 14 purchased without receiving any coupons in any season, while 23 purchased in the very first sales season without receiving any coupons. Our results are robust to the exclusion of these 50 observations.

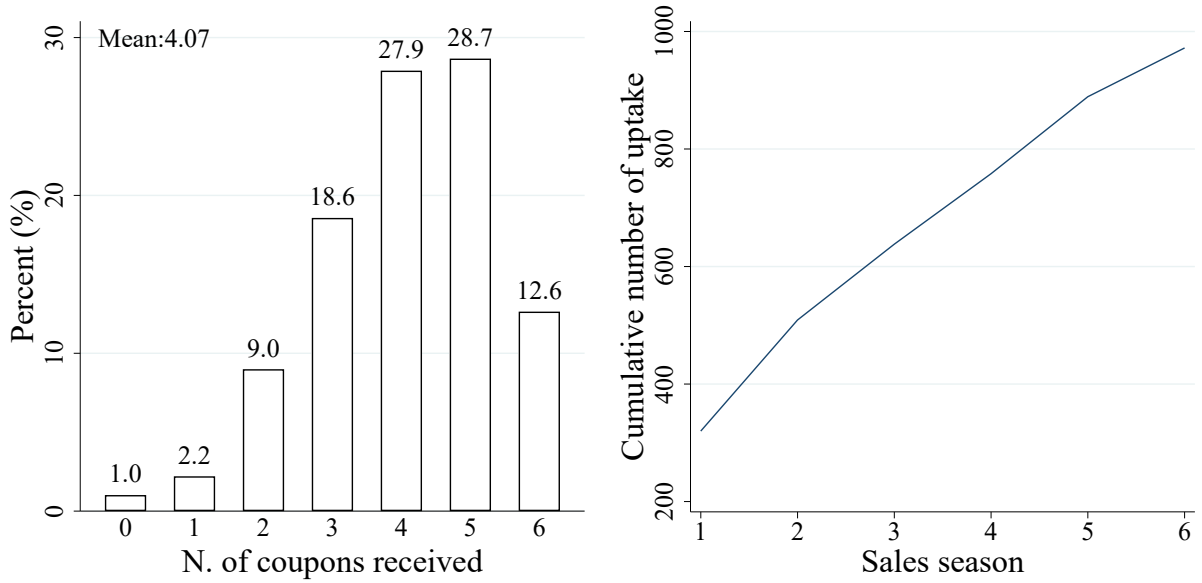
[21] We pre-specified two additional attrition tests. First, a joint test of selective attrition, which shows that only the number of adults in the household significantly predicts attrition (Appendix Table A5). Second, a test for differential attrition per survey round shows that respondents that received a discount coupon are 5 percentage points less likely to attrit in sales season 3 (Appendix Table A6).

Table 1: Summary statistics of the baseline characteristics

| | Kenya | | | | Ethiopia | | | | Pooled | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs |
| ***Prespecified household characteristics*** | | | | | | | | | | | | |
| Age of household head in years | 48.08 [18.35] | 18.00 | 98.00 | 781 | 50.23 [18.30] | 20.00 | 100.00 | 398 | 48.81 [18.35] | 18.00 | 100.00 | 1179 |
| Male headed household | 0.63 [0.48] | 0.00 | 1.00 | 781 | 0.79 [0.41] | 0.00 | 1.00 | 398 | 0.68 [0.47] | 0.00 | 1.00 | 1179 |
| Household head's years of education | 1.05 [3.07] | 0.00 | 16.00 | 771 | 0.54 [1.84] | 0.00 | 13.00 | 397 | 0.87 [2.72] | 0.00 | 16.00 | 1168 |
| Adult equivalent | 4.68 [1.95] | 0.70 | 12.90 | 781 | 4.94 [2.01] | 1.40 | 14.90 | 398 | 4.77 [1.97] | 0.70 | 14.90 | 1179 |
| Dependency ratio | 0.50 [0.21] | 0.00 | 1.00 | 781 | 0.54 [0.19] | 0.00 | 1.00 | 398 | 0.51 [0.20] | 0.00 | 1.00 | 1179 |
| Herd size (CMVE) | 25.48 [35.98] | 0.00 | 416.95 | 781 | 17.01 [23.90] | 0.00 | 277.38 | 398 | 22.62 [32.64] | 0.00 | 416.95 | 1179 |
| Annual income per adult equivalent (USD) | 121.45 [198.01] | 0.00 | 1617.14 | 781 | 102.79 [159.19] | 0.00 | 1639.55 | 398 | 115.15 [185.95] | 0.00 | 1639.55 | 1179 |
| Own or farm agricultural land | 0.18 [0.38] | 0.00 | 1.00 | 781 | 0.65 [0.48] | 0.00 | 1.00 | 398 | 0.34 [0.47] | 0.00 | 1.00 | 1179 |
| Fully settled | 0.23 [0.42] | 0.00 | 1.00 | 781 | 0.76 [0.43] | 0.00 | 1.00 | 398 | 0.41 [0.49] | 0.00 | 1.00 | 1179 |
| ***Baseline prespecified primary outcomes*** | | | | | | | | | | | | |
| Share of camels in herd (CMVE) | 0.30 [0.31] | 0.00 | 1.00 | 730 | 0.12 [0.21] | 0.00 | 0.98 | 395 | 0.23 [0.29] | 0.00 | 1.00 | 1125 |
| Share of cattle in herd (CMVE) | 0.30 [0.36] | 0.00 | 1.00 | 730 | 0.67 [0.25] | 0.00 | 1.00 | 395 | 0.43 [0.37] | 0.00 | 1.00 | 1125 |
| Share of goats in herd (CMVE) | 0.25 [0.26] | 0.00 | 1.00 | 730 | 0.17 [0.18] | 0.00 | 1.00 | 395 | 0.22 [0.24] | 0.00 | 1.00 | 1125 |
| Share of sheep in herd (CMVE) | 0.14 [0.17] | 0.00 | 1.00 | 730 | 0.05 [0.08] | 0.00 | 1.00 | 395 | 0.11 [0.15] | 0.00 | 1.00 | 1125 |
| Annual total household cash earning (USD) | 516.55 [828.25] | 0.00 | 6877.83 | 781 | 462.92 [594.14] | 0.00 | 5423.73 | 398 | 498.44 [757.52] | 0.00 | 6877.83 | 1179 |
| Maximum years of education | 3.54 [3.30] | 0.00 | 12.00 | 641 | 2.92 [2.55] | 0.00 | 10.00 | 333 | 3.33 [3.08] | 0.00 | 12.00 | 974 |
| ***Baseline prespecified secondary outcomes*** | | | | | | | | | | | | |
| Herd management expenditure (USD) | 48.79 [153.93] | 0.00 | 2395.60 | 781 | 41.00 [129.63] | 0.00 | 2146.89 | 398 | 46.16 [146.17] | 0.00 | 2395.60 | 1179 |
| Annual milk income (USD) | 886.09 [1668.25] | 0.00 | 12192.44 | 781 | 161.81 [265.31] | 0.00 | 2496.61 | 398 | 641.59 [1408.51] | 0.00 | 12192.44 | 1179 |
| Livestock lost in the past 12 months (CMVE) | 11.05 [15.22] | 0.00 | 116.90 | 781 | 9.20 [16.96] | 0.16 | 200.60 | 343 | 10.49 [15.79] | 0.00 | 200.60 | 1124 |
| Number of camel lost in the past 12 months (CMVE) | 1.15 [3.56] | 0.00 | 61.00 | 728 | 0.28 [0.81] | 0.00 | 6.00 | 343 | 0.87 [3.00] | 0.00 | 61.00 | 1071 |
| Number of cattle lost in the past 12 months (CMVE) | 5.13 [11.40] | 0.00 | 96.00 | 728 | 7.58 [16.04] | 0.00 | 199.00 | 343 | 5.92 [13.11] | 0.00 | 199.00 | 1071 |
| Number of goats/sheep lost in the past 12 months (CMVE) | 32.52 [55.13] | 0.00 | 607.00 | 728 | 5.69 [8.67] | 0.00 | 66.00 | 343 | 23.93 [47.39] | 0.00 | 607.00 | 1071 |
| Distress sale in the past 12 months (CMVE) | 0.77 [2.03] | 0.00 | 27.10 | 781 | 7.72 [19.66] | 0.00 | 206.75 | 398 | 3.12 [11.99] | 0.00 | 206.75 | 1179 |
| Share of children working full-time | 0.42 [0.41] | 0.00 | 1.00 | 610 | 0.47 [0.34] | 0.00 | 1.00 | 350 | 0.44 [0.39] | 0.00 | 1.00 | 960 |
| Share of children working part-time | 0.32 [0.41] | 0.00 | 1.00 | 610 | 0.26 [0.32] | 0.00 | 1.00 | 350 | 0.30 [0.38] | 0.00 | 1.00 | 960 |
| Share of children studying full-time | 0.26 [0.39] | 0.00 | 1.00 | 610 | 0.12 [0.23] | 0.00 | 1.00 | 350 | 0.21 [0.35] | 0.00 | 1.00 | 960 |
| Observations | 781 | | | | 398 | | | | 1179 | | | |

Notes: The table presents the summary statistics – mean, standard deviation (in square brackets), minimum value, maximum value, and the number of observations of each variable – of the study sample, by country, and in total. Adult equivalent is the weighted sum of the household members as their adult equivalent, based on the following age-specific weights: A household member between 16 to 65 (AE=1), a child under 5 (AE=0.5), a child between 5 to 15 (AE=0.7), a household member above 65 (AE=0.7). The dependency ratio is calculated by dividing the number of dependents (household members younger than 15 years old and older than 65 years old) by the number of household members in adult equivalents. Herd size is the sum of the animals herded by the household, aggregated using cattle market-value equivalent. Cattle market-value equivalent (CMVE) is a unit to aggregate the animals across different animal types based on their market values using panel survey data. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep. Annual total household cash earning is the sum of cash income from the following categories: sale of livestock, sale of livestock products, crop cultivation, salaried employment, casual labor, business and petty trading, and other major sources of income excluding gifts and remittances in the past 12 months. Herd management expenditure is the sum of the expenditure on water, fodder, supplementary feeding, and veterinary expenses.

Figure 3: Number of coupons received and cumulative number of policies sold by season



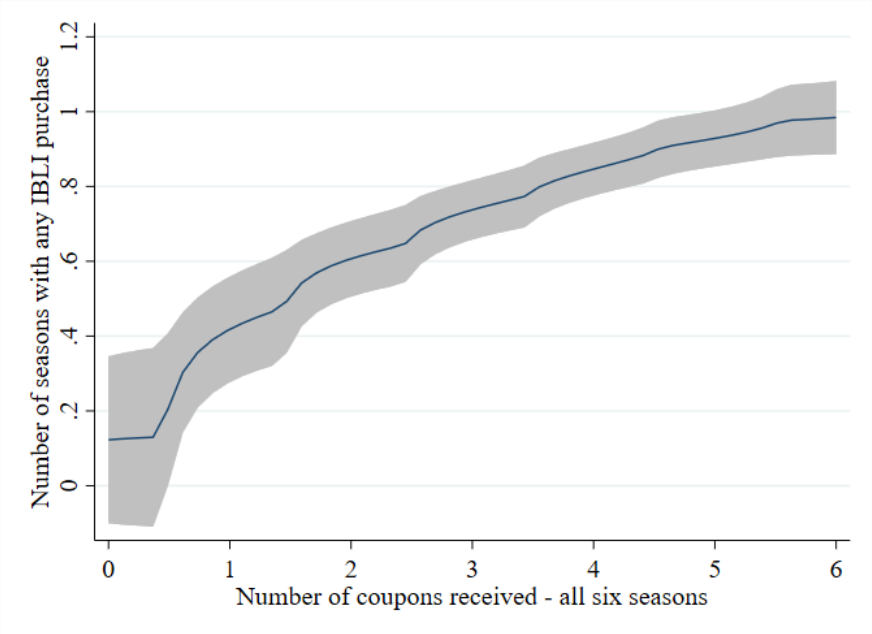

Notes: The left panel x-axis shows the number of coupons respondents received during the six sales seasons. The y-axis shows the percent of respondents who received 0, 1, 2, 3, 4, 5, or 6 discount coupons during these six sales seasons. The right panel shows a figure of cumulative IBLI policies sold by season.

Column 1 of Table 2 presents the first stage estimation results of Equation (3), the estimated effects of the number of discount coupons received during the first three sales seasons on purchase of any insurance within those same seasons. We report standard errors clustered at the household level (the level of randomization) and the community level, and we report p-values from randomization inference. The number of coupons received during the first three seasons significantly predicts the probability of purchasing insurance in the first three seasons at the one percent level.[22,23] An increase of one additional coupon received in these first three seasons increases the likelihood that a respondent purchased insurance, by 12.4 percentage points, significant at the one percent level. The effective F-statistics (Olea and Pflueger, 2013) are greater than the critical value at the 10 percent level, corroborating the strength of our instrument. Columns 2 through 7 present the estimated effects of receiving a discount coupon on insurance purchases in each round. Appendix Tables E6 - E23 show that our main second-stage results are robust to using alternative instruments, namely discount coupons during all six seasons, during the first two seasons, during the first four seasons

[22]In the pre-analysis plan, we pre-specified the cumulative insurance purchase {0,1,2,3} in the first three seasons as the endogenous variable. However, this specification violates the monotonicity assumption for a valid instrument (Appendix Table C2). Our results are robust to using the number of discount coupons and the number of insurance purchases in the first three seasons (Appendix Tables E21, E22, and E23).

[23]We do not include any analysis using the intensive margin of insurance uptake – the CMVE of animals insured because the number of coupons received by respondents is not a significant predictor of this intensive margin uptake.

Figure 4: Correlation of IBLI purchase and coupon receipt




Notes: The x-axis represents the number of discount coupons the respondent received. The y-axis shows the number of seasons in which the respondent purchased insurance over the six seasons. The line is a kernel-weighted local polynomial smooth plot with local mean smoothing. The shaded area represents the 95% confidence interval.

and during the first five seasons.

## 5.1 Long-run Effects of Catastrophic Drought Insurance

We report the results for all our pre-specified primary and secondary outcomes in Appendix Tables D1, D2, D3 and D4. We observe no statistically significant effects of insurance on total herd size,[24] annual household cash earnings, herd management expenditure, livestock losses, distress sales, livestock sales, nor the likelihood of purchasing insurance in the 12 months prior to the endline. The impacts on total milk income are large in magnitude but noisely estimated. We do, however, observe significant changes in our pre-specified measures of herd composition, education, and the likelihood that children study full-time, and marginally insignificant changes in the likelihood that children work.

Table 3 shows a substantial change in insured households' production strategies, reflected in changes in herd composition. Again we report standard errors clustered at the household level (the level of randomization) and the community level, and we report p-values from randomization

[24] Appendix Tables F1 show that results are robust to using CMVE or TLU.

inference. Column 3 shows a decrease of 20.9 percentage points in the share of small animals (goats and sheep) herded, significant at the ten percent level, relative to a control mean share of 43.4, implying a 48.2 percent decrease. By construction the herd share of large animals (camels and cattle) increased by the same magnitude (Column 1). Column 4 in Table 3 shows that we do not observe a significant effect on the number of small animals for the full sample. Column 3 shows a large but marginally insignificant increase in the number of large animals, of 6.3 relative to 9.2 animals in the control group, a 69% increase ($p$=0.156).

These mean effects mask important heterogeneity by baseline herd size distributions. Appendix Figure H1 shows that baseline herd size distributions are extremely right-skewed. 20 TLU, the 67th percentile of the baseline herd size distribution, reflects the upper end of the range where prior studies (using other data sets) find herd dynamics bifurcate, leading to convergence to two distinct stable herd size equilibria (Lybbert et al., 2004; Barrett et al., 2006; Santos and Barrett, 2011; Janzen and Carter, 2019; Santos and Barrett, 2019). Below this 20 TLU threshold at baseline, herd sizes decrease significantly among insured households, of 26 animals, relative to 39 in the control group, a 67% decrease, significant at the ten percent level. Meanwhile, for households in the top third of the baseline herd size distribution, we observe a significant 13.8 animal increase in the number of large animals herded among households who purchased insurance, from 7.0 in the control group, significant at the 10 percent level.

We do not observe increases in annual household cash earnings nor in cash milk income, our pre-specified income measures. But because pastoralists rely heavily on in-kind earnings, especially milk, we also analyze disaggregated in-kind and cash income.[25] For in-kind crop income, we observe precisely estimated, large, positive effects, significant at the one percent level for households with a small baseline herd size. Many of the other point estimates are large, albeit imprecise (Appendix Tables C3-C4).

Columns 1-3 of Table 4 present the effects of insurance on education, as measured by the maximum, total and average years of education of household members who were school-aged during the experiment.[26] We observe a substantial increase of 2.9 years in the maximum years of education, compared to 7.3 years in the control group, a 40% increase, significant at the ten percent level.[27] Column 2 shows that insured households have 7.3 years more total education among school-aged

[25] Appendix Tables G1 and G2 detail the in-kind income variables construction.

[26] Our pre-specified measure of education is the maximum years of education of all household members, which significantly increases by 1.6 years, from a control mean of 6.61, a 24.2 percent increase, which is marginally insignificant with a $p$-value of 0.135. Of course the years of education for household members that were above school-age during the experiment cannot increase, and this adds noise to our estimates of the effect of insurance. Therefore we construct and prefer education measures for household members who were school-aged during the experiment.

[27] Sample size drops to 742, the number of endline households with school-aged members during the experiment.

household members than households in the control group, who have 13.3 total years of education, a 55% increase, significant at the five percent level. Column 3 shows a 2.5 year increase in the average education of school-aged household members in insured households, significant at the ten percent level, compared to 5.3 years in the control group, a 48% increase. Panel B and C show the results on education, split into the lowest 2/3 and top 1/3 of the baseline herd distribution. The education results are driven by the lowest 2/3 of the baseline herd distribution, the same households that reduced the number of small animals herded. Small animals, particularly goats, are among the most labor-intensive livestock for children to manage. The more goats a household owns, the more children work (Appendix Figure C1), a relationship we explore in detail in Section 7.

Table 2: 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) | | | | | | |
| | [0.014] | | | | | | |
| | {0.000} | | | | | | |
| Coupon Receipt – first season | | 0.236*** | | | | | |
| | | (0.023) | | | | | |
| | | [0.032] | | | | | |
| | | {0.000} | | | | | |
| Coupon Receipt – second season | | | 0.078*** | | | | |
| | | | (0.022) | | | | |
| | | | [0.027] | | | | |
| | | | {0.000} | | | | |
| Coupon Receipt – third season | | | | 0.127*** | | | |
| | | | | (0.017) | | | |
| | | | | [0.031] | | | |
| | | | | {0.000} | | | |
| Coupon Receipt – fouth season | | | | | 0.066*** | | |
| | | | | | (0.017) | | |
| | | | | | [0.019] | | |
| | | | | | {0.002} | | |
| Coupon Receipt – fifth season | | | | | | 0.070*** | |
| | | | | | | (0.016) | |
| | | | | | | [0.033] | |
| | | | | | | {0.000} | |
| Coupon Receipt – sixth season | | | | | | | 0.058*** |
| | | | | | | | (0.013) |
| | | | | | | | [0.020] |
| | | | | | | | {0.000} |
| 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 |

Notes: The table presents the coefficients from the first stage linear probability model regressions in columns. Reported in parentheses are standard errors clustered at the household level (the level of randomization); brackets [ ] show standard errors clustered at the community level; and braces { } report p-values from randomization inference. Column 1 presents the estimated effect of the number of discount coupons received in the first three seasons on whether the respondent purchased any insurance in the first three seasons. The subsequent columns (Columns 2-7) present the estimated effect in each season of whether the respondent received a discount coupon on whether the respondent purchased any insurance. Community fixed effects are included as randomization was stratified at the community level. Our control variables are the pre-specified balance variables presented in Table 1: household head age, gender, and years of education, household adult equivalent, dependency ratio, herd size, annual income per adult equivalent, and dummies for agricultural land and whether fully settled. Effective F-statistics and 10 percent critical values are per Olea and Pflueger (2013) test for weak instruments. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table 3: Long-run effects of catastrophic drought insurance 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) |
| 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) |
| | [0.145] | [0.145] | [3.142] | [0.779] | [4.629] | [1.401] | [7.825] | [1.507] |
| | {0.048} | {0.043} | {0.116} | {0.413} | {0.642} | {0.051} | {0.050} | {0.274} |
| 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on herd composition. The dependent variables in columns 1 and 2 are the number of animals as a share of total household herd size. Columns 3-8 are numbers of large and small animals (in CMVE). Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. Community fixed effects are included as randomization was stratified at community level. Community fixed effects are included as randomization was stratified at community level. Reported in parentheses are standard errors clustered at the household level (the level of randomization); brackets [ ] show standard errors clustered at the community level; and braces { } report p-values from randomization inference. The row "Control Mean" reflects average outcomes for those who did not receive any coupons in the first three seasons. The row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3) of the baseline herd size distribution, while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

For a smaller subset of the sample we collected data on whether children are currently working or studying. Table D4 shows a substantial increase of 42.3 percentage points in the likelihood that children study full-time, relative to a control mean of 15.9 percent ($p$-value 0.092), consistent with results on education. We also observe a marginally insignificant increase in the likelihood of children working. Children's work falls by an estimated 55.0 percentage points, relative to a control mean of 55.3 ($p$=0.104). These results are not significantly different between the two-third of households with small baseline herds and the one-third of households with large baseline herds. These large education effects follow directly from the exceptionally low baseline rate of full-time school attendance and educational attainment among this population. The average years of education of school-going household members is 5.3 in the control group, and only 13% of household members that are school-aged are attending school full-time.[28]

### 5.2 Robustness to alternative controls or IV strategies

We present standard errors clustered at both the household level (the level of randomization) and the community level, and we report p-values from randomization inference. We also show that our results are robust to the exclusion of control variables in Appendix Tables E1-E3, correction for multiple hypothesis testing in Appendix Tables E4-E5, to the use of alternative instruments and endogenous regressors in our IV specification (all six seasons, first season only, first two seasons only, first four seasons only and first five seasons only) in Appendix Tables E6-E20, and the use of the number of coupons as the instrument and the number of insurance purchases as the endogenous regressor in the first three seasons in Appendix Tables E21-E23.

## 6 Robustness to interpersonal spillovers

We also consider the possibility that interpersonal spillovers violate the assumptions on which causal identification depends in our design. Given that randomization occurred at the individual-level, within communities, we test for robustness to intra-community spillovers. Such household spillovers could imply that the take-up or outcomes measured in control households are influenced

[28]To determine whether the educational effect is influenced by changes in household composition, Columns 1 and 2 in Table C6 show no effect of insurance purchase on the number of young adults in the household. So as to test for selective out-migration of higher educated young adults, we estimate correlations between the baseline average education of young adults, and the share of young adults at endline. The positive and significant estimates on baseline average education of young adults suggest that no such selection occurred; if anything, endogenous household composition would bias our estimated educational effects downwards. Table C7 shows the estimated relationship between children's educational attainment and the endline-baseline change in small ruminant holdings. The increase in education is greatest for those who lost the most goats or sheep.

Table 4: 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) |
| Panel A: All samples | | | |
| Any insurance purchased | 2.906* | 7.314** | 2.520** |
| | (1.544) | (3.704) | (1.276) |
| | [1.336] | [2.523] | [1.286] |
| | {0.052} | {0.036} | {0.041} |
| Controls | ✓ | ✓ | ✓ |
| Control mean | 7.255 | 13.275 | 5.296 |
| Complier mean | 7.123 | 12.746 | 5.592 |
| Observations | 742 | 742 | 742 |
| Panel B: Bottom 2/3 of baseline TLU | | | |
| Any insurance purchased | 5.658** | 14.535** | 5.254** |
| | (2.337) | (5.723) | (2.124) |
| | [2.213] | [3.460] | [2.065] |
| | {0.004} | {0.004} | {0.002} |
| Controls | ✓ | ✓ | ✓ |
| Control mean | 6.917 | 11.528 | 5.051 |
| Complier mean | 7.147 | 13.562 | 5.552 |
| Observations | 484 | 484 | 484 |
| Panel C: Top 1/3 of baseline TLU | | | |
| Any insurance purchased | -2.143 | -4.744 | -0.411 |
| | (2.708) | (5.804) | (1.898) |
| | [1.976] | [5.188] | [1.431] |
| | {0.414} | {0.382} | {0.850} |
| Controls | ✓ | ✓ | ✓ |
| Control mean | 8.067 | 17.467 | 5.884 |
| Complier mean | 7.077 | 11.231 | 5.666 |
| Observations | 258 | 258 | 258 |

Notes: This table presents the estimated Local Average Treatment Effect (LATE) of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during the initial three periods of experiments, i.e., household members who are currently 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. Community fixed effects are included as randomization was stratified at community level. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 742 of the 1179 households, excluding households without household members who were school-aged during the experiment. Reported in parentheses are standard errors clustered at the household level (the level of randomization); brackets [ ] show standard errors clustered at the community level; and braces { } report p-values from randomization inference. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

by the discount coupons received, insurance take-up or outcomes of treated households. Evidence of informal risk-sharing and informal transfers makes such spillovers plausible (Mobarak and Rosenzweig (2013), Riley (2018), Anderberg and Morsink (2020), Takahashi, Barrett, and Ikegami (2019), Berg, Blake, and Morsink (2022)).

The original experiment randomized households within communities, each season, to either receive discount coupons or not. At the level of households within a community this creates random variation in the intensity of encouragement received by peers. Table 5 shows that across communities, the number of peers treated per community varied between 3 and 160, with a mean of 80, the number of peers who purchased any insurance varied between 0 and 50, with a mean of 19, and the share of the community population that was treated varied between 0 and 35%. If we pool individuals in the sample across communities, across-community variation in the intensity of the instrument of both the recipient and their peers can be leveraged to investigate spillovers. We investigate these potential spillovers in the first stage – so from peers' discount coupons received on recipients' insurance purchase and vice versa – and in the second stage – from recipients' insurance purchase on peers' outcomes and vice versa. One challenge, given that our research was not designed to measure spillovers, is that the randomization within communities implies that coupon receipt by the recipient and their peers' are mechanically negatively correlated. Given the fixed pool of coupons assigned to a community, if one respondent received a coupon, their peers were (slightly) less likely to receive one. This also implies that the value of "discount coupon received" for households who are recipients of coupons will always be mechanically larger than the "discount coupons received" by their peers (Guryan, Kroft, and Notowidigdo, 2009; Caeyers and Fafchamps, 2020). This implies that we cannot include community fixed effects (Fruehwirth, Iyer, and Zhang, 2019; Rahman, 2023). We can only check if our main results are robust to potential spillovers, but we cannot quantify or even reliably sign the direction of spillovers, given that they are not separately identifiable from the mechanical correlation.

To explore the possibility of confounding due to spillovers, we first identify the potential spillover pathways (Figure 5). Let $D_{ij}$ denote discount coupon receipt by herder $i$ residing in community $j$, $I_{ij}$ represent insurance purchase, and $Y_{ij}$ denote the long-run outcome of this herder. Note that there exists a group of other herders, $-i$, whom we refer to as "peers," also from community $j$. We define $D_{-ij}$ as the peers' discount coupon receipt, $I_{-ij}$ as the peers' decision of whether or not to buy insurance, and $Y_{-ij}$ as the peers' long-run outcome. For this analysis, we assume that no inter-community spillovers exist. The blue line A represents the main causal effect of interest, namely the impact of $i$'s IBLI purchase on $i's$ long-run outcomes. Since insurance purchase is endogenous, we use exogenous variation created by the randomized discount coupons $D_{ij}$ as an instrument (pathway (11)) to estimate the LATE. The red arrow presents a direct violation of the

Table 5: 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 | 0.00 | 3.00 | 1.57 | 0.00 | 2.00 | 1.71 | 0.00 | 3.00 |
| | [0.87] | | | [0.60] | | | [0.79] | | |
| $I_{ij}$: Any insurance purchase | 0.43 | 0.00 | 1.00 | 0.45 | 0.00 | 1.00 | 0.44 | 0.00 | 1.00 |
| | [0.50] | | | [0.50] | | | [0.50] | | |
| $\overline{D}_{-ij}$: No. of coupons received | 100.88 | 44.00 | 160.00 | 40.22 | 3.00 | 68.00 | 80.41 | 3.00 | 160.00 |
| | [41.15] | | | [12.85] | | | [44.73] | | |
| $\overline{I}_{-ij}$: No. of peers who purchased any insurance | 22.83 | 8.00 | 50.00 | 11.38 | 0.00 | 19.00 | 18.96 | 0.00 | 50.00 |
| | [10.32] | | | [4.94] | | | [10.40] | | |
| Share of populaiton that was treated in the community | 0.04 | 0.01 | 0.20 | 0.13 | 0.00 | 0.35 | 0.07 | 0.00 | 0.35 |
| | [0.03] | | | [0.08] | | | [0.07] | | |

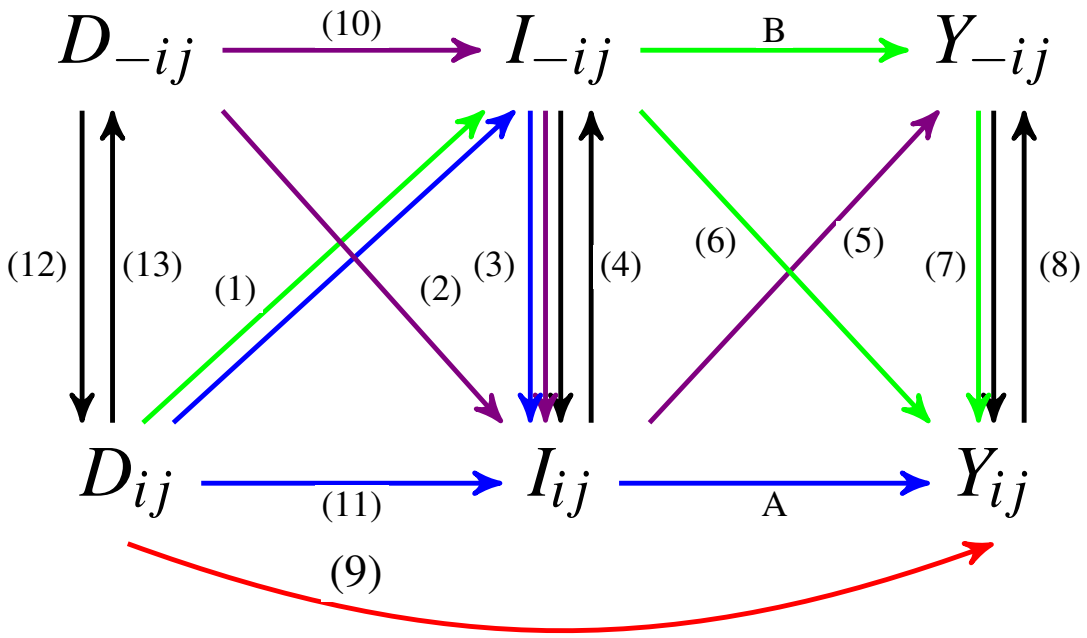
Notes: N=781 for Kenya, =398 for Ethiopia, and =1,179 for pooled. $D_{-ij}$ represents the number of peers in the village who received a discount coupon in the initial three seasons. $I_{-ij}$ denotes the number of peers who purchased any insurance within the first three seasons. See Appendix B for more details.

exclusion restriction, the green and purple arrows present spillovers in the first and second stage, out of which the green ones can lead to violations of the exclusion restriction. Black arrows present mechanical correlations generated by our experimental design. For a detailed description of all the spillover pathways, including examples, please see Appendix B.

To control for the potential confounding of spillovers empirically, we construct proxies for $D_{-ij}$ and $I_{-ij}$ for each respondent $i$: the number of coupons received by the peers and the number of peers who purchased insurance in the community. Following the same logic, we also create a vector of control covariates for all peers in the community. Table B1 shows the results of the first-stage estimates. Columns 1-3 show that the effect of the number of discount coupons received by the recipient on their insurance purchase is unaffected in magnitude and significance by inclusion of the peers' discount coupons' receipt. Columns 4-6 show that the effect of the number of discount coupons received by peers on peers' insurance purchase is unaffected in sign and significance by the discount coupons received by the recipient. Together, these findings suggest that spillovers from discount coupons received by peers, if they exist, do not meaningfully affect coupon recipients' insurance purchase, and vice versa. This also implies that we can control for spillovers in the second-stage using the discount coupons received by peers as a valid instrument to identify insurance purchase by peers.

We test for the robustness of our main results by including the mean number of discount coupons received by peers as an additional instrument, and mean insurance purchase by peers as an additional endogenous regressor in our main specifications in equations (2) and (3). Tables B2, B3, and B4 present the second-stage results. The main results are all qualitatively similar after inclusion of these additional peer variables, although for some effects we lose statistical power due to the addition of another instrument and endogenous regressor and the omission of community fixed effects.

Figure 5: DAG: potential spillover interaction




*Notes*: Pathways are indicated by (1)-(13) and A and B. $D_{ij}$ refers to the discount coupons received by herder $i$ in community $j$, $I_{ij}$ to their insurance purchase, and $Y_{ij}$ to their long-run outcome. Denoting other herders from community $j$, termed "peers," as $-i$, their discount coupons received, insurance purchase, and long-run outcomes are $D_{-ij}$, $I_{-ij}$, and $Y_{-ij}$, respectively. The main causal effect of interest is A, the LATE estimate of $I_{ij}$ on $Y_{ij}$, instrumenting $I_{ij}$ by $D_{ij}$. Blue arrows present this main specification. The red pathway presents a standard, direct violation of the exclusion restriction. Green pathways present indirect violations of the exclusion restriction and violations of SUTVA, the purple pathways present violations of SUTVA. Black arrows indicate mechanical negative correlations. See Appendix B for more details.

The effects on herd composition remain unchanged at a 23.1 percentage points reduction in the share of small animals herded, significant at the ten percent level (versus a 20.9 percentage points decrease when not controlling for potential interpersonal spillovers and including community fixed effects). The heterogeneous effects by baseline herdsize also remain qualitatively similar, with a decrease of 33 small animals among the two-third of households with small herd size at baseline, and an increase in 17 large animals among the one-third of households with a large herd size at baseline (versus 26 and 14, respectively, when not controlling for potential interpersonal spillovers and including community fixed effects). The estimated effects for maximum, total and average years of education are now 3.3, 8.1, and 2.6 years respectively, not significantly different from our main results, neither for our full sample, nor for our two sub-samples. The estimated effect on whether children work or study full-time is directionally unchanged but no longer statistically

significant. Overall, these robustness checks reinforce our central findings.[29]

# 7 Mechanisms

We now explore candidate mechanisms for the observed long-run outcomes of catastrophic drought insurance. Endline insurance coverage can be ruled out because it was not affected by the treatment (Table D4), for reasons already discussed. The observed effects must thus have begun during the experimental period of (transitory) insurance uptake in the initial few years after the insurance was first introduced.

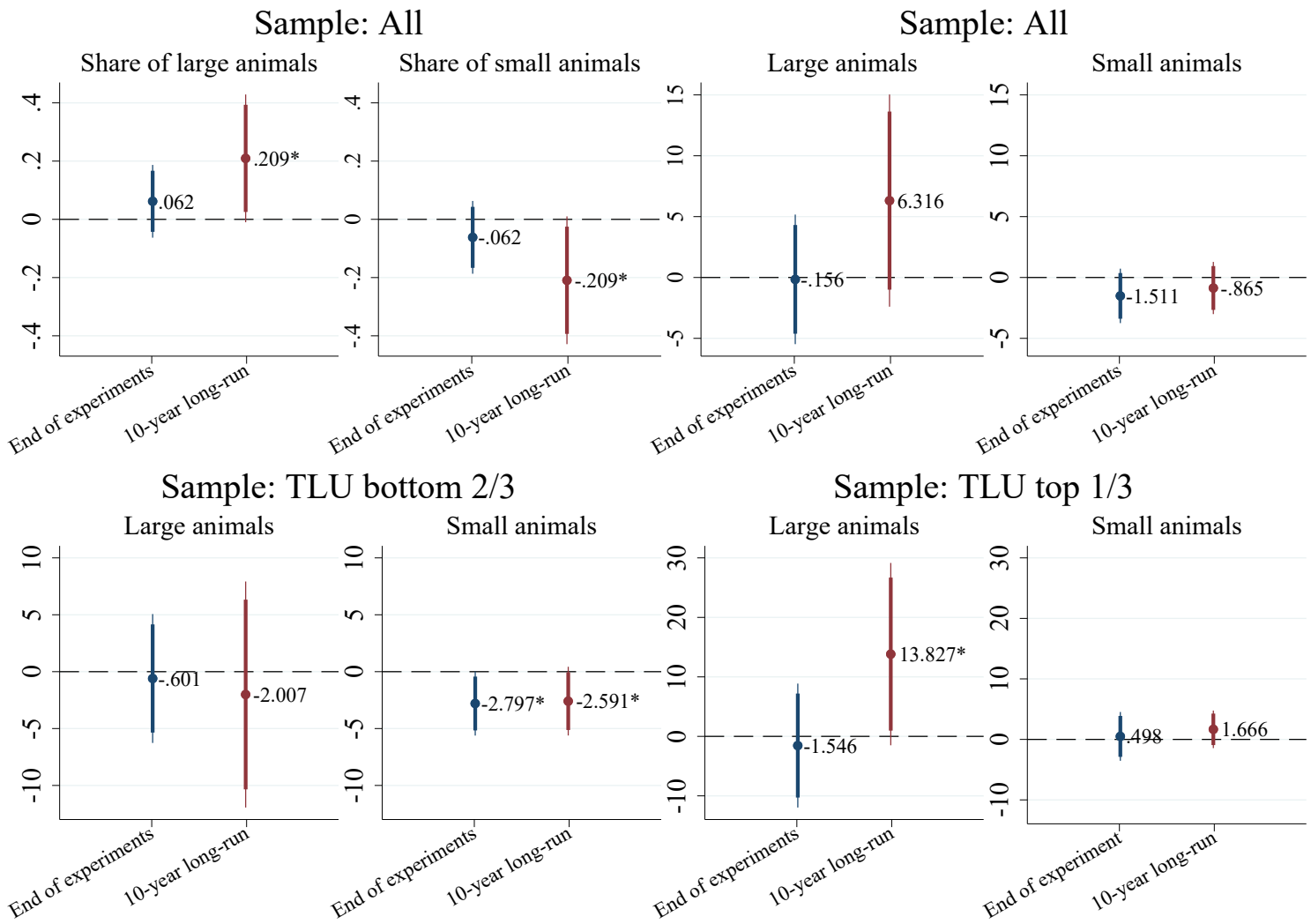
## 7.1 Impact dynamics over the study period

The observation that early, temporary adoption of insurance generated effects long after households ceased buying insurance suggests that the initial coverage or insurance payments induced changes in insured households' dynamic equilibrium behaviors. Some such changes could be immediate, while households converge on others over time after shifting path dynamics. Unpacking that induced change requires exploring how effects emerge over time, i.e., the induced change in households' path dynamics following (temporary) insurance coverage.

We estimate Equation (2) on the same outcomes at the end of experiments. The bottom panel in Figure 6 shows the dynamic effects of interest for the lowest two-third and the top one-third of the baseline herd size distribution.[30] We see a negative and significant 2.8 CMVE reduction in small animals at the end of the experiment, an effect of similar magnitude as the long-run effect, while there is no effect on large animals for the smaller baseline herds sub-sample. For the top one-third sub-sample we observe no effects on small animals, and a significant increase of 13.8 CMVE in large animals only at endline. The top panel in Figure 6 shows that, in the full sample, the herd composition effect materialized quite immediately and then persisted and became stronger and significant over time, with a 20.9 percentage point reduction at the 10-year follow-up, significant at the 10 percent level. We also show the number of large and small animals for the full sample, with significant negative point estimates for small animals throughout, while no trend appears in the large number of animals, and the marginally insignificant increase appears only at the 10-year follow-up.

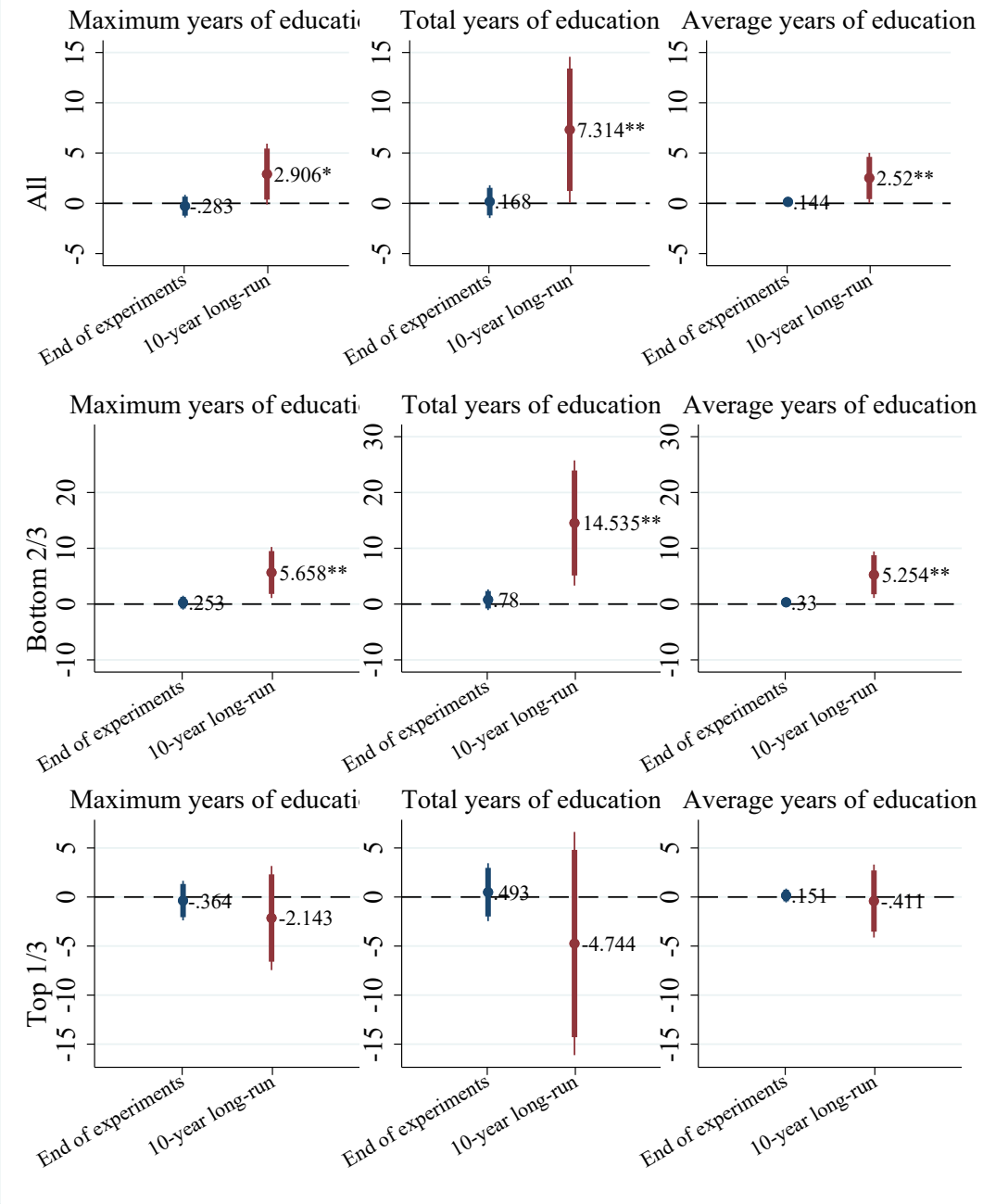
[29] The results are robust to different combinations of own and peers' control variables (Appendix Tables B5-B8).
[30] See Appendix Table C8 and C9 for regression results.

Figure 6: Dynamic effects on herd composition (CMVE)




Notes: These figures present the estimated LATE of any insurance purchase in the first three seasons–instrumented by the number of discount coupons received by recipients in the first three seasons–on herd composition. The outcomes are the number of large vs. small animal types in the household's herd, expressed in CMVE and divided by the total number of animals in the household's herd (also expressed in CMVE) in the top left panel, while the number of large vs. small animal types in the household's herd is expressed in CMVE in the other panels. The LATE is estimated for the following time points: (i) after the end of the experiment (sixth sales season) and (ii) at the 10-year follow-up. The top left figure excludes households that do not herd any livestock. The top right figure represents the full sample. The bottom left figure includes households in the bottom one-third (1/3) of the baseline herd size distribution, while the bottom right focuses on those above the bottom two-thirds (2/3). The boxes represent the 90 percent confidence intervals, and the lines represent the 95 percent confidence intervals. The numbers above the boxes present the LATE estimates. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Figure 7: Dynamic effects on maximum, total, and average years of education




Notes: This figure presents the estimated LATE of any insurance purchase in the first three seasons – instrumented by the number of discount coupons received by recipients in the first three seasons – on outcomes "Maximum years of education", "Total years of education", and "Average years of education" measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (i) after the end of the experiment (sixth sales season) and (ii) at the 10-year follow up. All samples are included for the top panels, while the middle panel focuses on the subsample of households whose baseline TLU quantiles were in the 2/3 percentile and the bottom panel focuses on those whose baseline TLU quantiles were in the top 1/3 percentile. The boxes present the 90 percent confidence intervals, and the lines represents the 95 percent confidence intervals. The numbers above the boxes present the estimate of the LATE. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Figure 7 and Appendix Table C10 show that the effects on education achievement only materialized by the time of the 10-year follow-up both for the full sample and the lowest two-thirds sub-sample while there are no significant effects on education for the top one-third sub-sample.

These results underscore that the effects on herd composition and educational attainment – driven by the lowest two-third of households in terms of the baseline herd size distribution – are substantively linked, not just coincidental in time. The sequencing of observed impacts suggests that the long-term effects of insurance arise due to induced shifts in pastoralist production strategies, with a reduction among those with smaller herds in lower-value, more liquid small animals like goats that typically provide liquidity and are used as precautionary savings. Insurance coverage reduced the need for these precautionary savings, likely increasing the productivity of the remaining herd. Even after insurance was no longer available, the increased productivity and income replaced the need for holding precautionary savings in the form of small animals, thus households did not revert to restocking with goats after insurance coverage ceased. While positive income effects – through crop income – may have incentivized educational investment directly, the reduced number of goats herded also weakened household demand for child labor. Children are far less likely to herd large animals like camels or cattle, than goats or sheep. Camels in particular are large, strong and ornery, managed overwhelmingly by adult men. Our results suggest that the observed changes in herd composition may have reduced the marginal productivity of child herding labor (Columns (5)-(8) in Appendix Table D4). This would have increased incentives to educate children, similar to Shah and Steinberg (2017) and Bau et al. (2024).

In support of our interpretation, we rule out that insurance coverage reduced migration among pastoral households, thereby promoting sedentarization, which in turn could have driven the education effects as children would have remained at home and therefore been able to attend school. First, goats, which comprise the largest share of small animals herded in our sample, are browsers, so typically do not need to migrate long distances like cattle do. This makes it unlikely that the reduction in herding of small animals affected migration patterns. Furthermore, Appendix Table E24 shows that there are no significant effects of insurance coverage on migration and sedentarization, as observed during the 10-year follow-up. The observed reduction in small ruminants and the corresponding increase in education do not appear to be mediated by decreased migration.

## 7.2 Insurance coverage versus indemnity payments

If insurance coverage reduced the need for precautionary savings among households with smaller baseline herds, and incentivized investment in larger, riskier, but higher-return animals among households with larger baseline herds, then the long-run outcomes we estimate should be driven

by *ex ante* (of drought) insurance coverage not by *ex post* indemnity payments triggered by (exogenous) low NDVI readings during droughts. The indemnity payments from insurance provided households a lump sum cash transfer, that could have incentivized purchase of lumpy assets, or investments in education. This would parallel prior studies on the effects of cash transfer interventions (Angelucci, Attanasio, and Di Maro, 2012; Haushofer and Shapiro, 2016; Blattman et al., 2016; Baird, McIntosh, and Özler, 2019).

Only 116 households in our sample received indemnity payments, with 54 insured households experiencing one drought and 62 insured households experiencing two droughts during the experiment period. This implies that we have limited statistical power to distinguish effects of insurance coverage from the effect of indemnity payments so our results should be interpreted as suggestive only.

We do, however, modify the prior regression specification to include the number of indemnity payments received per household as an additional endogenous regressor conditional on both (instrumented) insurance purchase and the number of (exogenous) drought shocks that were triggered by the index. Given the limitations of this analysis any results should be considered suggestive. We estimate the following second-stage equation:

$$y_{ijT} = \gamma_1 \widehat{I_{ij}} + \gamma_2 \widehat{I_{ij}} \times R_j + \gamma_3 R_j + \gamma_4 y_{ij0} + \gamma_5 X_{ij0} + \gamma_6 D_{ij4}^{t=6} + \varepsilon_{ijT} \tag{6}$$

where $R_j$ is the number of times the index was triggered in the index unit and $\gamma_2$ is the estimate of the predicted insurance uptake interacted with the number of times the index was triggered, and can be interpreted as the number of predicted payouts.

The coefficient $\gamma_1$ captures the effect of (predicted) insurance uptake on the outcome in the absence of a payout, which we can think of as the "peace-of-mind" (*ex ante*) effect of insurance (Tafere, Barrett, and Lentz, 2019). The combined effects of purchasing insurance and the number of times that an indemnity payments is received are captured by $\gamma_1 + \gamma_2$, which is the marginal effect of coverage plus the indemnity payout. We do not incorporate community fixed effects because we are interested in comparing the estimated effect of insurance (without indemnity payments) to the estimated effect of insurance with indemnity payments, controlling for the severity of droughts. The fact that the index is triggered at the index unit level, implies that there is no community-level variation in indemnity payments among clients in the same community that purchased insurance, which would be needed to estimate their impacts.

Appendix Tables C11 and C12 show the results of estimating Equation (6) for the herd composition and education outcomes. The number of shocks substantially and often significantly reduces

the number of large and small animals that respondents own, as expected. The marginal effects of receiving insurance and an indemnity payment ($\gamma_1 + \gamma_2$) appear in the first row of the bottom part of each panel, its $p$-value in the second row. In none of the full sample analyses in Panel A, and in only one of the estimations in the sub-sample analyses in Panels B and C, is the interaction between the predicted insurance purchase and the number of shocks significant. Only for the reduction in small animals among the lowest two-third sub-sample do we see a significant interaction effect, whereby the indemnity payment offsets the loss of small animals arising from the shock. Several of the estimates on the interaction effect and the combined effect appear large, with large standard errors, suggesting a lack of power. It should be noted, however, that the estimated effects of insurance coverage remain similar to the effect we observe in Table 3, indicating robustness of the core qualitative findings.

These results provide suggestive evidence that a cash liquidity injection from indemnity payments does not explain our long-run results. This is consistent with broader findings in the literature that cash transfers' short-run effects often do not persist to generate long-term effects (Araujo, Bosch, and Schady, 2017; Baird, McIntosh, and Özler, 2019; Blattman, Dercon, and Franklin, 2022; Blattman, Fiala, and Martinez, 2020). Rather, these results suggest that the main effects we estimate are driven by insurance coverage. Our evidence is thus most consistent with an interpretation that reduced *ex ante* risk exposure and the behavioral changes it induces, not the cash transfers resulting from the indemnity payment, generate the long-run effects we observe. This is confirmed in prior findings of subjective well-being gains from insurance coverage even in the absence of payouts (Tafere, Barrett, and Lentz, 2019), as well as *ex ante* effects of insurance on increases in productive investments, irrespective of indemnity payments (Karlan et al., 2014; Cole and Xiong, 2017; Jensen, Barrett, and Mude, 2017; Hill et al., 2019; Matsuda, Takahashi, and Ikegami, 2019; Boucher et al., 2021; Stoeffler et al., 2022; Son, 2025).

The overall changes in herd composition and the heterogeneous effects conditional on baseline herd size are thus best explained by *ex ante* reduction in risk exposure, and the behavioral effect this induces. Insured households in the lowest two-thirds of the baseline herd distribution hold fewer small animals, likely because of reduced need for precautionary savings in the form of highly liquid goats, to cover potential drought-related expenditures on food (to replace lost milk production), fodder, water, and veterinary expenses.[31] The increase in the number of large animals herded among the top one-third of the baseline herd size distribution may have occurred because

[31]The phrase "sold a goat to insure a cow" is often heard among insurance purchasers. Indeed, some portion of the herd composition shift may result from households selling goats to purchase insurance coverage. However, the estimated treatment effect on the share of goats exceeds by an order of magnitude the average insurance premia that households paid. So liquidating goats to pay insurance premia can only explain a small share of the observed herd composition shift.

insurance coverage incentivized investment in larger-risk but larger-return animals, represented by camels and cattle.

# 8 Conclusions

A growing literature has established that uninsured exposure to catastrophic aggregate shocks can have adverse effects on long-run human capital accumulation, partly depending on the marginal labor productivity of children in those contexts Shah and Steinberg (2017) and Bau et al. (2024). It follows, therefore, that insurance against such shocks might boost human capital accumulation. Direct evidence on this important question had, however, been lacking to date.

We test the long-run effects of catastrophic drought insurance by exploiting the randomized encouragement design of the original impact evaluation of index-based livestock insurance (IBLI), a catastrophic drought insurance product introduced among pastoral populations in northern Kenya and southern Ethiopia in 2010-12, and followed up with the original survey households ten years later. We find that temporary insurance coverage immediately sharply changed households' production strategies, an effect that persisted in the long-run and led to a long-run increase in children's educational attainment, and in ways consistent with prior findings of multiple equilibrium herd sizes in this system (Lybbert et al., 2004; Barrett et al., 2006; Santos and Barrett, 2011; Janzen and Carter, 2019). Insured pastoralist households that began with large enough herds of productive camels and cattle remained migratory, even during severe droughts, and were able to grow their herds. But among the poorer two-thirds of households, whose baseline herd size left them especially vulnerable to catastrophic drought shocks, insurance induced them to liquidate smallstock held as precautionary savings. This reduced the marginal productivity of child labor, increased children's likelihood of studying full time, and at the 10-year follow-up resulted in sharply increased educational attainment among this poorer subpopulation. Our evidence suggests that these effects are driven by the insurance coverage itself rather than by receipt of cash indemnity payments triggered by drought events. The reduced *ex ante* drought risk exposure through insurance coverage and the behavioral changes insurance caused, seem to have generated the observed long-term effects, not the improved financial liquidity arising from lump-sum cash transfers due to indemnity payments. This underlines the importance of households being aware of their insurance status, which may not be the case when aggregators purchase coverage on behalf of households, or in case of large-scale social safety net programs.

Our research illuminates the important role that formal risk mitigation instruments may play for human capital accumulation and how those are mediated by the livelihood strategies households

pursue. Our results are especially and immediately relevant for the major, four-country initiative now underway to scale the IBLI-based drought insurance program to reach 3.2 million pastoralists across the Horn of Africa. While catastrophic drought insurance, even if available temporarily, can help facilitate households' transition to more productive livestock portfolios and thereby protect human capital from drought shocks and promote children's education, complementary interventions are necessary to help relieve the continuing, severe poverty that afflicts many pastoralist households in the region.

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# Appendix

# A Balance and Attrition

## A.1 Balance

This subsection presents the tests of balance of the randomized discount coupon offers for each season. We estimate the following equation for our pre-specified set of balance variables that were selected following Jensen, Barrett, and Mude (2017) and Takahashi et al. (2016)[32]:

$$k_{ijt} = \gamma_1 \mathrm{D}_{ijt} + \rho_j + \nu_{ijt} \tag{7}$$

where $k_{ijt}$ denotes a characteristic of a household $i$ in location $j$ in sales season $t$, $D_{ijt}$ is an indicator for whether or not the household $i$ in location $j$ received a discount coupon in sales season $t$, $\rho_j$ is the location fixed effects, and $\nu_{ijt}$ is the error term, clustered at the household level.

In addition to the coefficient estimates and standard errors, we use the normalized difference as a scale-invariant measure of the size of the difference in means between households with and without discount coupons, which we calculate by:

$$\text{Normalized Difference} = \frac{\bar{X}_{treatment} - \bar{X}_{control}}{\sqrt{(s^2_{treatment} + s^2_{control})/2}} \tag{8}$$

where $\bar{X}$ represents the mean and $s$ the standard deviation of a variable.

As stated in the main body of the text, results reported in Table A1 show that randomization was balanced across observables in each season.

## A.2 Attrition

This subsection presents the analysis of attrition. At baseline, 1439 households participated in our panel survey. Ten years later we were able to track 1179, or 82% of these households (Table A2).

We first verify if we have differential attrition across discount coupon assignment. Because our

[32] Variables include: age of the household head, an indicator for whether the household is male headed, years of education of the household head, adult equivalent, dependency ratio, herd size in CMVE, annual income per capita in USD, and whether the household owned or farmed on agricultural land in the last 12 months.

is the number of seasons that a household received a coupon during the first three sales seasons, we test for differential attrition by estimating Eq. (9):

$$\text{Attrition}_{ijT} = \delta_1 \text{D}_{ij} + \gamma_j + \omega_{ij} \tag{9}$$

where $Attrition_{ijT}$ is an indicator that equals 1 if a household $i$ in location $j$ was interviewed at baseline (2009 in Kenya, 2012 in Ethiopia), but not during the long-run follow-up survey round (2020 in Kenya and 2022 in Ethiopia). $\text{D}_{ij}$ is the number of sales seasons out of the initial three where a household received a discount coupon. $\gamma_j$ represents location fixed effects, and $\omega_{ij}$ the error term, clustered at the household-level. Column (1) of Table A3 reports the results, and we do not find significant differential attrition by our instrument. As pre-specified in our pre-analysis plan we also estimate differential attrition based on the number of coupons received in all six sales seasons, and Column (2) of Table A3 shows that there is no differential attrition.

Discount rates may separately affect the probability of a household to attrit differentially, conditional on receiving a discount coupon. Therefore, we estimate the following equation to evaluate attrition by discount coupon receipt and discount rate for each sales season separately:

$$\text{Attrition}_{ijT} = \kappa_1 \text{D}_{ijt} + \kappa_2 \text{Discount Rate}_{ijt} + \kappa_3 \text{Absent}_{ijt} + \rho_j + \omega_{ijt} \tag{10}$$

where $\text{D}_{ijt}$ is an indicator equal to one if a household $i$ in location $j$ in sales season $t$ received a discount coupon. $\text{Discount Rate}_{ijt}$ is the coupon discount rate in percentages, defined as zero if the household did not receive any discount. Since some households drop out from the panel survey in a specific round, to return a round later, we include $Absent_{ijt}$, an indicator denoting that the household was absent from the panel survey in specific sales season $t$. $\rho_j$ represents location fixed effects, and $\omega_{ijt}$ is the robust standard error. The estimated results reported in Table A6 show that there is no differential attrition by discount coupon receipt, except for sales season 3, where those who received a discount coupon are significantly less likely to attrit than those who did not receive a discount coupon, statistically significant at the 95 percent level. This effect is driven by individuals who are temporarily absent in round 3, but reappear in the data in later rounds. There is no differential attrition by the randomly assigned discount rate.

Finally, we consider selective attrition by our pre-specified observable household characteristics. We regress each household characteristic on the attrition indicator:

$$X_{ij0} = \zeta_1 Attrition_{ijT} + \rho_j^1 + \sigma_{ijt}^1 \tag{11}$$

where $X_{ij0}$ is the vector of characteristics of household $i$ in community $j$ at baseline. In addition to each coefficient, we also conduct joint significance tests to verify if all characteristics combined are jointly statistically significantly different. As reported in the main text, Table A4 shows that households that are female-headed, that have fewer adults, and that do not own agricultural land were more likely to attrit from the sample.

As per the pre-analysis plan, we also test selective attrition by regressing the attrition indicator on the vector of baseline household characteristics. We estimate the following equation:

$$Attrition_{ijT} = \theta_1 X_{ij0} + \rho_j^2 + \sigma_{ijt}^2 \tag{12}$$

where all variables are defined following Equation 11. The results reported in Table A5 show that an additional adult household member increases the likelihood of attritioon by 1 percentage points, significant at the 10 percent level. None of the other pre-specified observables significantly predict attrition.[33]

[33] In this table, we replace the missing values with a mean of existing observations and include a dummy variable indicating missing in the regression, to utilize information from all households. We use winsorized value for income per adult equivalent, earnings from livestock sale, and livestock expenditure.

Table A1: Balance by discount coupon receipt per season

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

Notes: The table presents the effects of whether or not a household received a discount coupon prior to each sales season on our pre-specified balance variables. Each outcome is a characteristic of a household $i$ in area $j$ in sales season $t$. Columns (1) to (6) report mean differences, robust standard errors (in parentheses), and normalized differences (in square brackets) between the coupon recipients and non-recipients. All estimations include community fixed effects. Column (7) reports joint significance test for each variable across seasons where the first row presents the Chi-statistic and the second row presents the $p$-value of the test statistic in curly brackets. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table A2: Number of households present in each round

| | Kenya | | | Ethiopia | | |
|---|---|---|---|---|---|---|
| | Total | Original sample | *Net* re-placement | Total | Original sample | *Net* re-placement |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| R1 | 924 | 924 | . | 515 | 515 | . |
| R2 | 924 | 887 | 37 | 506 | 474 | 32 |
| R3 | 924 | 857 | 30 | 514 | 479 | 3 |
| R4 | 924 | 838 | 19 | 513 | 470 | 8 |
| R5 | 923 | 829 | 8 | 438 | 398 | |
| R6 | 919 | 785 | | | | |
| R7 | 868 | 781 | | | | |
| Balanced sample | | 712 (77 %) | | | 387 (75 %) | |
| Initial & Last | | 781 (85 %) | | | 398 (77 %) | |

Notes: The table shows the number of households interviewed in each round. Columns (1) and (4) show the number of households surveyed each panel survey round. Columns (2) and (5) show the number of sampled households in each round that are common with original samples in round 1, which constructs the balanced panel. Columns (3) and (6) show the number of households that were replaced. Rows "Balanced sample" and "Initial & Last" show the number of households surveyed in all periods, and that of $R1$ and $R7$, respectively.

Table A3: Differential attrition by the number of coupons received

| | Outcome: Interviewed at baseline but not in the final 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 |

Notes: The table presents the effect of the number of discount coupons received on attrition, where the outcome $Attrition_{ijT}$ is an indicator that equals 1 if a household $i$ in location $j$ was interviewed at baseline (2009 in Kenya, 2012 in Ethiopia), but not during the long-run follow-up survey round (2020 in Kenya and 2022 in Ethiopia). Estimated coefficients and robust standard errors (in parentheses) are reported in each column. All estimations include community fixed effects. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table A4: Attrition by household baseline characteristics

| | Independent variable: Interviewed at baseline but not in the final 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 value of joint F-test | 0.016 |
| N | 1439 |

Notes: The table presents effects of each household characteristic on attrition among our sample, using different household characteristics as outcomes in each row. The variable $Attrition_{ijT}$ is an indicator that equals 1 if a household $i$ in location $j$ was interviewed at baseline (2009 in Kenya, 2012 in Ethiopia), but not during the long-run follow-up survey round (2020 in Kenya and 2022 in Ethiopia). Mean differences and robust standard errors (in parentheses) between the attrited and non-attrited households are reported. Attrition is defined as a household $i$ in area $j$ was interviewed at baseline, but not in the latest round. All estimations include community fixed effects. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. The $p$-value of the joint significance test for all variables across attrition is reported at second from the bottom row.

Table A5: Joint test of selective attrition

| | Outcome: Interviewed at baseline but not in the final round (=1) |
|---|---|
| | (1) |
| Age of the household head | -.000372 |
| | (.000596) |
| Male headed household (=1) | -.0357 |
| | (.0255) |
| Education of household head | .00429 |
| | (.00441) |
| Adult equivalent | -.0122** |
| | (.00526) |
| Dependency ratio | -.0196 |
| | (.0512) |
| Herd size (CMVE) | .000421 |
| | (.000354) |
| Annual income per AE (USD) | .0000429 |
| | (.0000718) |
| Own or farm agricultural land | -.0482 |
| | (.0343) |
| *P*-value of joint F-test | 0.024 |
| N | 1439 |

Notes: The table presents effects of attrition on pre-specified household characteristics jointly among our sample, where the outcome $Attrition_{ijT}$ is an indicator that equals 1 if a household $i$ in location $j$ was interviewed at baseline (2009 in Kenya, 2012 in Ethiopia), but not during the long-run follow-up survey round (2020 in Kenya and 2022 in Ethiopia). Estimated coefficients and robust standard errors (in parentheses) are reported. All estimations include community fixed effects. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. The $p$-value of the joint significance test for all variables across attrition is reported at second from the bottom row.

Table A6: Differential attrition across coupon receipt status

| | Outcome: Interviewed at baseline but not in the final round (=1) |
|---|---|
| | (1) |
| ***Sale season 1*: 2010 JF (Kenya), 2012 AS (Ethiopia)** | |
| Received coupon | .0214 |
| | (.026) |
| Discount Rate | -.000136 |
| | (.000498) |
| ***Sale season 2*: 2011 JF (Kenya), 2013 JF (Ethiopia)** | |
| Received coupon | -.0362 |
| | (.0242) |
| Discount Rate | .000616 |
| | (.000467) |
| ***Sale season 3*: 2011 AS (Kenya), 2013 AS (Ethiopia)** | |
| Received coupon | -.0525** |
| | (.0249) |
| Discount Rate | .000704 |
| | (.000478) |
| ***Sale season 4*: 2012 AS (Kenya), 2014 JF (Ethiopia)** | |
| Received coupon | .00744 |
| | (.0252) |
| Discount Rate | -.000327 |
| | (.000474) |
| ***Sale season 5*: 2013 JF (Kenya), 2014 AS (Ethiopia)** | |
| Received coupon | .00978 |
| | (.0248) |
| Discount Rate | -.000154 |
| | (.000464) |
| ***Sale season 6*: 2013 AS (Kenya), 2015 JF (Ethiopia)** | |
| Received coupon | .0394 |
| | (.0265) |
| Discount Rate | -.000524 |
| | (.000372) |
| N | 1439 |

Notes: The table presents the effect of whether or not a household has receive a coupon ("received coupon") and the discount rate assigned ("discount rate", ranging between 0% and 80%) on attrition, where the outcome $Attrition_{ijT}$ is an indicator that equals 1 if a household *i* in location *j* was interviewed at baseline (2009 in Kenya, 2012 in Ethiopia), but not during the long-run follow-up survey round (2020 in Kenya and 2022 in Ethiopia). Estimated coefficients and robust standard errors (in parentheses) are reported. All estimations include country and community fixed effects. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

# B Interhousehold Spillovers

Our estimate of the Local Average Treatment Effect (LATE) is a valid estimator of the causal effect of IBLI if our design satisfies the following assumptions: (i) Stable Unit Treatment Values Assumption (SUTVA); (ii) the exclusion restriction; (iii) monotonicity (iv) exogeneity of the instrument.

To estimate the causal effect of IBLI on long-run outcomes, we use the number of randomized discount coupons received during the first three seasons of IBLI sales as an instrument for whether or not a respondent took up any IBLI during the first three seasons. This is a context where we should anticipate two-sided non-compliance, so we check that we satisfy the monotonicity assumption in Table C2. Our results demonstrate that the likelihood of IBLI take-up in the first three seasons monotonically increases with the number of coupons received during the first three seasons.

If we assume that the receipt of discount coupons and the take-up of insurance do not generate spillovers – and thus SUTVA is not violated – it is unlikely that the exclusion restriction is violated through spillovers. This is because discount coupons were randomly assigned across households in communities, were non-transferable and expired at the end of each season. However, if we relax SUTVA, we should consider spillovers in the second stage, from a herder's insurance purchase decision onto their peers' insurance purchase decision; from a herder's purchase decision onto their peers' outcomes; or from a herder's outcomes onto their peers' outcomes. Furthermore, spillovers may also arise in the first stage, where a herder's receipt of a discount coupon affects their peers' insurance purchase. Because the effect of a herder's discount coupons on their long-run outcomes still runs solely through the herder's insurance purchase, these spillovers would not violate the exclusion restriction. However, the effect of our instrument on insurance purchase now consists of a direct and an indirect effect.

Figure 5 summarizes all potential spillovers, of which not all are a concern from the perspective of estimating a valid LATE. For completeness, we start by providing examples of each potential spillover in our context in the list below before we discuss which of those create a concern from the perspective of generating a valid LATE.

- Pathway (1) and (2): The receipt of a discount coupon by a herder affects the likelihood that their peers take-up insurance, and vice versa. In our context, examples of this might be that herder $i$, upon receiving the discount coupon, also receives *information* about insurance that they communicate to $-i$, which makes $-i$, irrespective of their own coupon receipt, more likely to purchase insurance. Alternatively, receiving a discount coupon by $i$ could lead

to *status concerns* that (dis)incentivize $-i$ to purchase insurance, irrespective of their own coupon receipt.

- Pathway (3) and (4): The insurance purchase by a herder has an effect on the likelihood that their peer purchases insurance and vice versa. Examples of this in our context are *social learning*, where $-i$ learns about insurance from $i$, or *copying*, where $-i$ wants to exhibit the same behaviour as $i$. Another example is *free-riding*, which refers to the fact that $i$'s insurance purchase decreases the incentive for $-i$ to purchase insurance. This may occur because $i$ and $-i$ informally share risk through transfers, and $-i$ anticipates transfers following claim payments by $i$, or in case $-i$ views $i$'s insurance purchase as an opportunity to learn about the insurance product.

- Pathway (5) and (6): The insurance purchase by herder $i$ changes the outcomes of a peer ($Y_{-ij}$) directly, not through the outcomes of $i$ (see pathway (7) and (8) below). An example would be a case where the willingness to share risk through informal transfers by either $i$ or $-i$ is changed as a result of their insurance status. For example, Takahashi, Barrett, and Ikegami (2019) shows that a herder's insurance uptake has no effect on her willingness to transfer to peers, but insurance purchase by peers does increase herder $i$'s willingness to transfer. Alternatively, if formal insurance is available, and $i$ purchases insurance but $-i$ does not, $i$ may become less willing to transfer to $-i$ because $-i$ refrained from protecting themselves by purchasing insurance and instead decided to free-ride on $i$'s insurance purchase (Berg, Blake, and Morsink, 2022).

- Pathway (7) and (8): The outcomes of herder $i$ affect the outcomes of their peers, or vice versa. This is empirically difficult to distinguish from the mechanisms discussed in pathways (5) and (6). Examples would be where claim payments received by $i$ increase $i$'s income, and as a result, $i$ increases transfer to $-i$.

Based on Figure 5 we can categorize threats to a valid LATE as arising from a combination of violations of the exclusion restriction, SUTVA, and violations of SUTVA only.

From the perspective of the *exclusion restriction*, the only pathways of spillovers that are a concern are pathways from $D_{ij}$ to $Y_{ij}$ that do not run through $I_{ij}$. These are:

- pathway (1) $\rightarrow$ (6)
- pathway (1) $\rightarrow$ B $\rightarrow$ (7)

The following pathways are not a concern from the perspective of the exclusion restriction, because they all run from $D_{ij}$ to $I_{ij}$ to $Y_{ij}$:

- pathway (1) $\rightarrow$ (3) $\rightarrow$ A;
- pathway (1) $\rightarrow$ (3) $\rightarrow$ (5) $\rightarrow$ (7);
- pathway (11) $\rightarrow$ (4) $\rightarrow$ (6);
- pathway (11) $\rightarrow$ (4) $\rightarrow$ B $\rightarrow$ (7).

Any pathways that run from $D_{-ij}$ to $Y_{ij}$, either through $I_{ij}$ or $I_{-ij}$ do not pose a violation of the exclusion restriction because they do not affect the causal effect of the instrument $D_{ij}$ on $I_{ij}$. They do, however, change the overall population of compliers to treatment, and – if spillovers exist in the second stage – would thus affect the estimate of the $\hat{I}_{ij}$ on $Y_{ij}$. This can happen through:

- (2) $\rightarrow$ A;
- (2) $\rightarrow$ (4) $\rightarrow$ (6);
- (2) $\rightarrow$ (4) $\rightarrow$ B $\rightarrow$ (7);
- (10) $\rightarrow$ (3) $\rightarrow$ A;
- (10) $\rightarrow$ (3) $\rightarrow$ (5) $\rightarrow$ (7);
- (10) $\rightarrow$ (6)
- (10) $\rightarrow$ (B) $\rightarrow$ (7).

As we only have random variation in $D_{ij}$ and $D_{-ij}$, we can only estimate the causal pathways (1), (2), (10), and (11). Any effects beyond this coming from $D_{ij}$ – such as pathway (1) $\rightarrow$ (3) – cannot be causally interpreted. It is the result of the fact that instrumenting $I_{-ij}$ with $D_{ij}$ is required for a causal interpretation, but the existence of (11) implies that the exclusion restriction would be violated if we do so.

Therefore, we first focus on estimating the direct effects on the first stage only, which would include:

- pathway (1): $D_{ij}$ on $I_{-ij}$
- pathway (2): $D_{-ij}$ on $I_{ij}$
- pathway (10): $D_{-ij}$ on $I_{-ij}$
- pathway (11): $D_{ij}$ on $I_{ij}$

and the combinations of the two direct effects:

- pathways (1) and (10): $D_{ij}$ & $D_{-ij}$ on $\bar{I}_{-ij}$
- pathways (2) and (11): $D_{ij}$ & $D_{-ij}$ on $I_{ij}$

## B.1 Estimation Strategies

To investigate spillovers empirically, we construct the following variables for $-i$:

- $-i's$ coupon receipt ($\overline{D}_{-ij}$): This is constructed by creating a variable for each herder $i$ that is the number of coupons received by the peers discount coupons in the first three seasons by all other herders ($-i$) in their community $j$:

$$\overline{D}_{-ij} := \sum_{-i_j=1}^{n_j} [\text{No. of coupons received - first three seasons}]_{-ij}$$

  where [No. of coupons received - first three seasons]$_{-ij}$ is the total number of coupons distributed in the community to all herders except for $i$ in the initial three seasons.

- $-$i's insurance uptake ($\bar{I}_{-ij}$): This is constructed by creating a variable for each herder $i$ that is the number of peers who purchased any insurance $-i$ out of all herders in the community except for $i$ that purchased any insurance during the first three seasons:

$$\bar{I}_{-ij} := \sum_{-i_g=1}^{n_j} [\text{Any insurance purchased - first three seasons}]_{-ij}$$

  where [Any insurance purchased - first three seasons]$_{-ij}$ is a binary variable that is one if the households bought insurance at least once in the first three sales seasons.

We also create a vector of control covariates for all herders $-i$ in community $j$ in the same way that we create the above-mentioned variables, which we define as $\overline{X}_{-ij0}$.

We show the summary statistics of these variables in Table 5. By construction – because all herders are included as $i$ in $D_{ij}$ and $Y_{ij}$, and they are also included as $-i$ in $\overline{D}_{-ij}$ and $\overline{Y}_{-ij}$ – the means of these $-i$ variables across the entire sample are always the same as the mean for the $i$ variables, but the standard deviation is reduced. As a result, if one were to estimate correlations between these two variables, mechanically, we would expect a negative correlation.

Table B1: Spillover effects: First stage

| | Outcome: Any insurance purchase - first three seasons | | | | | |
|---|---|---|---|---|---|---|
| | $I_{ij}$: Recipient's | | | $\bar{I}_{-ij}$: 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 |

Notes: The table presents the effects of number of coupons received by recipients ($D_{ij}$) and peers in the first three seasons ($D_{-ij}$) on any insurance purchased by the recipients ($I_{ij}$) and the number of peers purchased insurance during the first three seasons $I_{-ij}$. Columns 1-3 show the effect of the number of coupons the recipient received, and the number of coupons received by the peers in the initial three seasons on any insurance purchased by the recipient. Columns 4-6 show the effect of the number of coupons the recipient received, and the number of coupons received by the peers in the initial three seasons on the number of peers who purchased any insurance. $D_{ij}$ and $\overline{D}_{-ij}$ are the number of coupons received by the recipient $i$ and the number of coupons received in the first three seasons by all other herders ($-i$) in their community $j$ except for $i$, respectively. $I_{ij}$ and $\bar{I}_{-ij}$ are any insurance purchase in the first three seasons by recipient $i$ and the number of herders $-i$ out of all herders in the community except for $i$ that purchased any insurance during the first three seasons, respectively. The row "Pathway (DAG)" indicates the potential spillover pathways that may exist in our first- or second- stages corresponding to the numbers in Figure 5. We include peers' control variables but not recipient controls in this specification. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. The row labeled '(Control) mean outcomes' presents the mean of the outcomes for individuals who did not purchase any insurance during the first three seasons in columns 1 and 3, and for those whose peers received zero coupons in columns 4 and 6. The values are missing when no observations meet these conditions. The data includes all the sample households of 1179. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table B2: Spillover effects on livestock holdings

| | 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) |
| $\widehat{I_{ij}}$: 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) |
| $\bar{I}_{-ij}$: 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 TLU) | 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 |

Notes: The table presents the effects of any insurance purchase during the first three seasons by the recipient ($I_{ij}$) and the number of insurance purchase by peers $I_{-ij}$ during the first three seasons as instrumented by the number of coupons received by the recipient $i$ ($D_{ij}$) and the number of coupons received by all other herders ($-i$) in their community $j$ ($D_{-ij}$) in the first three seasons on herd composition. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of large and small animals expressed in CMVE. Standard errors are clustered at the household-level, as this was the level of randomization. We include peers' control variables in this specification. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. Community fixed effects are not included. Community fixed effects are not included. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3), while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table B3: 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) |
| Panel A: All samples | | | |
| $\widehat{I_{ij}}$: 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 |
| Panel B: Bottom 2/3 of baseline TLU | | | |
| $\widehat{I_{ij}}$: 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 |
| Panel C: Top 2/3 of baseline TLU | | | |
| $\widehat{I_{ij}}$: 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 |

Notes: The table presents the effects of any insurance purchase during the first three seasons by the recipient ($I_{ij}$) and the number of insurance purchase by peers $I_{-ij}$ during the first three seasons as instrumented by the number of coupons received by the recipient $i$ ($D_{ij}$) and the number of coupons received by all other herders ($-i$) in their community $j$ ($D_{-ij}$) in the first three seasons on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during the initial three periods of experiments, i.e., household members who are currently 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Standard errors are clustered at the household-level, as this was the level of randomization. We include peers' control variables in this specification. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. Community fixed effects are not included. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 742 of the 1179 households, excluding households without household members who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table B4: 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 |

Notes: The table presents the effects of any insurance purchase during the first three seasons by the recipient ($I_{ij}$) and the number of insurance purchase by peers $I_{-ij}$ during the first three seasons as instrumented by the number of coupons received by the recipient $i$ ($D_{ij}$) and the number of coupons received by all other herders ($-i$) in their community $j$ ($D_{-ij}$) in the first three seasons on child time use. The dependent variables "Working " and "Studying full-time" were only measured at endline in Ethiopia, and represent the share of current children aged 5-17 in the household that are reported to be engaged in each activity. Standard errors are clustered at the household-level, as this was the level of randomization. We include peers' control variables in this specification. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. Community fixed effects are not included. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 376 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table B5: Spillover effects: First stage 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) |
| $\overline{D}_{-ij}$ : 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 |
| 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) |
| $\overline{D}_{-ij}$ : 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 |

Notes: The table presents the effects of number of coupons received by recipients and peers in the first three seasons on any insurance purchased by the recipients and the number of peers purchased insurance during the first three seasons. Columns 1-3 show the effect of the number of coupons the recipient received, and the number of coupons received by the peers in the initial three seasons on any insurance purchased by the recipient. Columns 4-6 show the effect of the number of coupons the recipient received, and the number of coupons received by the peers in the initial three seasons on the number of peers who purchased any insurance. $D_{ij}$ and $\overline{D}_{-ij}$ are the number of coupons received by the recipient $i$ and the number of coupons received in the first three seasons by all other herders $(-i)$ in their community $j$ except for $i$, respectively. $I_{ij}$ and $\bar{I}_{-ij}$ are any insurance purchase in the first three seasons by recipient $i$ and the number of herders $-i$ out of all herders in the community except for $i$ that purchased any insurance during the first three seasons, respectively. Panel A presents the results including both recipient and peer control variables, while Panel B shows the results with only recipient control variables. The row "Pathway (DAG)" indicates the potential spillover pathways that may exist in our first- or second- stages corresponding to the numbers in Figure 5. We include peers' control variables but not recipient controls in this specification. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. The row labeled '(Control) mean outcomes' presents the mean of the outcomes for individuals who did not purchase any insurance during the first three seasons in columns 1 and 3, and for those whose peers received zero coupons in columns 4 and 6. The values are missing when no observations meet these conditions. The data includes all the sample households of 1179. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table B6: Spillover effects on livestock holdings with control variables

| | Number of animal type / Total number of animals (CMVE) | | Number of animals (CMVE) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Large | Small | Large | Small | Large | Small | Large | Small |
| Panel A: With both own and peers' control variables | | | | | | | | |
| $\widehat{I}_{ij}$: Any insurance purchase | 0.204* | -0.204* | 6.461 | -1.005 | -2.951 | -2.993* | 17.040** | 2.086 |
| | (0.120) | (0.120) | (4.842) | (1.194) | (5.617) | (1.719) | (8.096) | (1.610) |
| $\bar{I}_{-ij}$: No. of peers who purchased any insurance | -0.002 | 0.002 | -0.070 | -0.019 | -0.157** | -0.033 | 0.209 | 0.057 |
| | (0.003) | (0.003) | (0.088) | (0.024) | (0.080) | (0.027) | (0.299) | (0.069) |
| 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 TLU) | 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 |
| Panel B: With own control variables | | | | | | | | |
| $\widehat{I}_{ij}$: 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 (Baseline TLU) | 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 |

Notes: The table presents the effects of any insurance purchase during the first three seasons by the recipient ($I_{ij}$) and the number of insurance purchase by peers $I_{-ij}$ during the first three seasons as instrumented by the number of coupons received by the recipient $i$ ($D_{ij}$) and the number of coupons received by all other herders ($-i$) in their community $j$ ($D_{-ij}$) in the first three seasons on herd composition. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Standard errors are clustered at the household-level, as this was the level of randomization. We do not include control variables for both recipient (i) and peers (-i) in Panel A, but only recipient in Panel B. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3), while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table B7: 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 | | | |
| $\widehat{I_{ij}}$: 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 |
| Panel B: With own control variables | | | |
| $\widehat{I_{ij}}$: 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 |

Notes: The table presents the effects of any insurance purchase during the first three seasons by the recipient ($I_{ij}$) and the number of insurance purchase by peers $I_{-ij}$ during the first three seasons as instrumented by the number of coupons received by the recipient $i$ ($D_{ij}$) and the number of coupons received by all other herders ($-i$) in their community $j$ ($D_{-ij}$) in the first three seasons on education outcomes. The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during the initial three periods of experiments, i.e., household members who are currently 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). We do not include control variables for both recipient (i) and peers (-i) in Panel A, but only recipient in Panel B. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 742 of the 1179 households for Columns 1-3 and 376 for Columns 4-5 (only available in Ethiopia), excluding households without household members who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

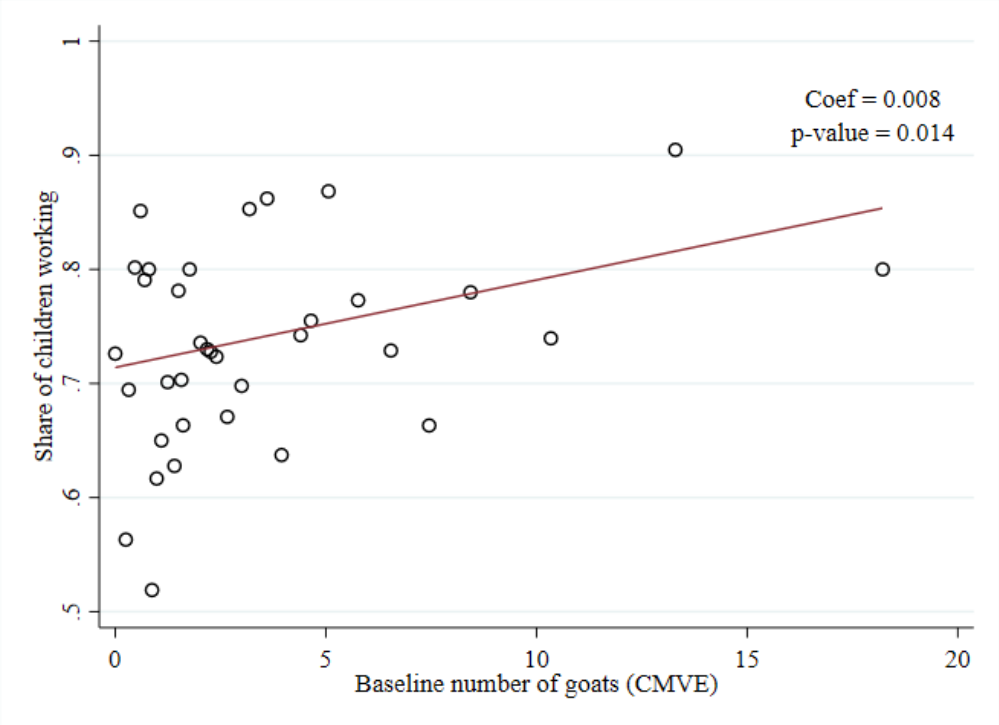
Table B8: Spillover effects on child time use with control variables

| | Share of children in the household | |
|---|---|---|
| | Working | Studying full-time |
| | (1) | (2) |
| Panel A: With both own and peers' control variables | | |
| $\widehat{I_{ij}}$: 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 | | |
| $\widehat{I_{ij}}$: Any insurance purchase | -0.528 | 0.436 |
| | (0.374) | (0.277) |
| $\bar{I}_{-ij}$: No. of peers who purchased any insurance | -0.001 | 0.011* |
| | (0.008) | (0.006) |
| Recipient controls (i) | ✓ | ✓ |
| Peer's controls (-i) | | |
| Community FE | | |
| Control mean | 0.553 | 0.159 |
| Complier mean | 0.464 | 0.221 |
| Observations | 376 | 376 |

Notes: The table presents the effects of any insurance purchase during the first three seasons by the recipient ($I_{ij}$) and the number of insurance purchase by peers $I_{-ij}$ during the first three seasons as instrumented by the number of coupons received by the recipient $i$ ($D_{ij}$) and the number of coupons received by all other herders ($-i$) in their community $j$ ($D_{-ij}$) in the first three seasons on education outcomes. The dependent variables "Working " and "Studying full-time" were only measured at endline in Ethiopia, and represent the share of current children aged 5-17 in the household that are reported to be engaged in each activity. We do not include control variables for both recipient (i) and peers (-i) in Panel A, but only recipient in Panel B. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. We do not include community fixed effect in this specification. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 376 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

# C Tables and Figures Referenced in Text

Figure C1: Child time use and number of goats at baseline survey




Notes: This figures presents the bins scatter plot between share of children who are working and the number of goats (CMVE) at baseline survey (number of bins is 40). Cattle market-value equivalent (CMVE) is a unit to aggregate the animals across different animal types based on their market values using panel survey data. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table C1: Summary statistics of outcome variables

| | Kenya | | | | Ethiopia | | | | Pooled | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs |
| Herd size (CMVE) | 12.96 | 0.00 | 349.80 | 781 | 16.51 | 0.00 | 498.78 | 398 | 14.16 | 0.00 | 498.78 | 1179 |
| | [24.46] | | | | [38.72] | | | | [30.07] | | | |
| Share of camels in herd (CMVE) | 0.31 | 0.00 | 1.00 | 619 | 0.10 | 0.00 | 1.00 | 395 | 0.23 | 0.00 | 1.00 | 1014 |
| | [0.38] | | | | [0.22] | | | | [0.34] | | | |
| Share of cattle in herd (CMVE) | 0.21 | 0.00 | 1.00 | 619 | 0.65 | 0.00 | 1.00 | 395 | 0.38 | 0.00 | 1.00 | 1014 |
| | [0.35] | | | | [0.23] | | | | [0.38] | | | |
| Share of goats in herd (CMVE) | 0.34 | 0.00 | 1.00 | 619 | 0.18 | 0.00 | 1.00 | 395 | 0.28 | 0.00 | 1.00 | 1014 |
| | [0.35] | | | | [0.17] | | | | [0.30] | | | |
| Share of sheep in herd (CMVE) | 0.14 | 0.00 | 1.00 | 619 | 0.06 | 0.00 | 0.83 | 395 | 0.11 | 0.00 | 1.00 | 1014 |
| | [0.20] | | | | [0.08] | | | | [0.17] | | | |
| Annual total household cash earning (USD) | 515.08 | 0.00 | 5636.45 | 781 | 564.31 | 0.00 | 3649.52 | 398 | 531.70 | 0.00 | 5636.45 | 1179 |
| | [671.37] | | | | [597.82] | | | | [647.64] | | | |
| Maximum years of education | 7.58 | 0.00 | 14.00 | 578 | 4.96 | 0.00 | 12.00 | 164 | 7.01 | 0.00 | 14.00 | 742 |
| | [4.97] | | | | [3.60] | | | | [4.82] | | | |
| Herd management expenditure (USD) | 139.34 | 0.00 | 3648.66 | 666 | 227.00 | 0.00 | 4817.14 | 398 | 172.13 | 0.00 | 4817.14 | 1064 |
| | [290.75] | | | | [425.09] | | | | [349.53] | | | |
| Annual milk income (USD) (earnings and in-kind) | 540.99 | 0.00 | 21957.05 | 781 | 111.00 | 0.00 | 11895.60 | 398 | 395.84 | 0.00 | 21957.05 | 1179 |
| | [1361.23] | | | | [634.35] | | | | [1184.86] | | | |
| Livestock lost in the past 12 months (CMVE) | 3.00 | 0.00 | 56.80 | 781 | 9.95 | 0.00 | 352.32 | 398 | 5.35 | 0.00 | 352.32 | 1179 |
| | [6.38] | | | | [24.68] | | | | [15.59] | | | |
| N of lost camel | 1.08 | 0.00 | 28.00 | 578 | 0.57 | 0.00 | 25.00 | 398 | 0.87 | 0.00 | 28.00 | 976 |
| | [3.25] | | | | [2.29] | | | | [2.91] | | | |
| N of lost cattle | 0.53 | 0.00 | 40.00 | 578 | 8.36 | 0.00 | 300.00 | 398 | 3.73 | 0.00 | 300.00 | 976 |
| | [2.46] | | | | [22.47] | | | | [14.97] | | | |
| Number of lost goats/sheep | 17.95 | 0.00 | 270.00 | 578 | 1.02 | 0.00 | 52.32 | 398 | 11.05 | 0.00 | 270.00 | 976 |
| | [32.47] | | | | [3.09] | | | | [26.40] | | | |
| Distress sale in the past 12 months (CMVE) | 0.49 | 0.00 | 25.60 | 781 | . | . | . | 0 | 0.49 | 0.00 | 25.60 | 781 |
| | [2.01] | | | | [.] | | | | [2.01] | | | |
| Share of children working full-time | . | . | . | 0 | 0.28 | 0.00 | 1.00 | 376 | 0.28 | 0.00 | 1.00 | 376 |
| | [.] | | | | [0.31] | | | | [0.31] | | | |
| Share of children working part-time | . | . | . | 0 | 0.18 | 0.00 | 1.00 | 376 | 0.18 | 0.00 | 1.00 | 376 |
| | [.] | | | | [0.30] | | | | [0.30] | | | |
| Share of children studying full-time | . | . | . | 0 | 0.23 | 0.00 | 1.00 | 376 | 0.23 | 0.00 | 1.00 | 376 |
| | [.] | | | | [0.29] | | | | [0.29] | | | |
| IBLI uptake in the past 12 months (=1 if purchased) | 0.00 | 0.00 | 1.00 | 781 | 0.15 | 0.00 | 1.00 | 398 | 0.05 | 0.00 | 1.00 | 1179 |
| | [0.04] | | | | [0.36] | | | | [0.22] | | | |
| IBLI uptake in the past 12 months (CMVE) | 0.02 | 0.00 | 13.80 | 781 | 1.80 | 0.00 | 100.00 | 398 | 0.62 | 0.00 | 100.00 | 1179 |
| | [0.49] | | | | [7.22] | | | | [4.30] | | | |
| Observations | 781 | | | | 398 | | | | 1179 | | | |

Notes: All columns present mean, standard deviations (in square brackets), and the number of observations for each variable. Age-specific weights for adult equivalent are as follows: A household member between 16 to 65 (AE=1), a child under 5 (0.5 AE), a child between 5 to 15 (AE=0.7), a household member above 65 (AE=0.7). Dependency ratio is calculated by the number of dependents (household members younger than 15 years old and older than 65 years old) divided by the number of household members. Herd size in CMVE is the sum of the animals herded by the household, aggregated using cattle market-value equivalent. Cattle market-value equivalent (CMVE) is a unit to aggregate the animals across different animal types based on their market values using panel survey data. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep. Annual total household cash earning is the sum of income from the following categories: sale of livestock, sale of livestock products, crop cultivation, salaried employment, casual labor, business and petty trading, and other major sources of income excluding gifts and remittances during the recent 4 pastoral seasons. Herd management expenditure includes expenditure on water, fodder, supplementary feeding, and veterinary expenses.

Table C2: Checking monotonicity assumption

| | Number of seasons purchase IBLI (%) | | | |
|---|---|---|---|---|
| Panel A. Number of coupons recipient's received | 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 |

| | Whether or not to purchase IBLI (%) | |
|---|---|---|
| Panel B. Number of coupons recipient's received | 0 | 1 |
| 0 | 76.250 | 23.750 |
| 1 | 65.819 | 34.181 |
| 2 | 50.953 | 49.047 |
| 3 | 43.452 | 56.548 |

Notes: The table shows the relationship between the number of coupons recipients received and the purchase of IBLI in the initial three sales seasons. Panel A presents the number of seasons in which IBLI was purchased, while Pnael B indicate whether IBLI was purchased in any of the initial three sales seasons.

Table C3: Long-run effects of catastrophic drought insurance 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: Bottom 2/3 of baseline TLU | | | | | | | | | | |
| 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: Top 1/3 of baseline TLU | | | | | | | | | | |
| 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 |

Notes: The table presents Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on income outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variable of column 1 is the aggregated annual total household income (sum of columns 2-10 expressed in USD. The dependent variables of columns 2-10 are annual income from each category of income expressed in USD. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. The FDR adjusted p-values (q-values) are reported in square brackets for outcomes that were not pre-specified, calculated according to the sharpened process Anderson (2008). Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. Please refer to Appendix G for the definition of outcome variables.

Table C4: Long-run effects of catastrophic drought insurance on aggregated income

| | 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: Bottom 2/3 of baseline TLU | | | | |
| 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: Top 1/3 of baseline TLU | | | | |
| 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 |

Notes: The table presents Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on income outcomes aggregated over livestock and crop. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables of columns 1 and 3 are annual total livestock income expressed in USD and its dummy, respectively, while the ones in columns 2 and 4 are annual total crop income expressed in USD and its dummy, respectively. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. Please refer to Appendix G for the definition of outcome variables.

Table C5: Education - not yet school age during the experiment but were at endline

| | 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: Bottom 2/3 of baseline TLU | | | |
| 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: Top 1/3 of baseline TLU | | | |
| 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 |

Notes: The table presents Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables are "Maximum years of education", "total years of education", and "average years of education" among household members who were not yet school-aged during experiment (i.e., 6-14 in Kenya and 7-14 in Ethiopia at endline survey) but were at endline survey (2020 in Kenya and 2022 in Ethiopia). Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 1015 of the 1179 households excluding households without household members who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table C6: Effects on the number of young adults (18-25 years old)

| | Outcomes: Number of young adults | |
|---|---|---|
| | (1) | (2) |
| Any insurance purchased | 0.204 | 0.106 |
| | (0.308) | (0.270) |
| Baseline N of young adults | 0.040 | -0.246*** |
| | (0.039) | (0.049) |
| Adult equivalent | | 0.287*** |
| | | (0.024) |
| Herd size (CMVE) | | -0.002* |
| | | (0.001) |
| Controls | | ✓ |
| Control mean | 0.912 | 0.912 |
| Observations | 781 | 781 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on the number of young adults. The dependent variable is "number of young adults" (18-25 years old). Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. The data for the outcome is only available in Kenya which yields 781 observations. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table C7: Change in educational attainment outcomes and change in the small ruminants

| | | Subsample by reduction in small ruminants | | | Pairwise t-test | | |
|---|---|---|---|---|---|---|---|
| | Full sample | 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 |

Notes: The table presents summary statistics for the changes in educational attainment among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old) by the change in small ruminants (goats and sheep) from baseline (2009 in Kenya, 2012 in Ethiopia) to endline survey (2020 in Kenya and 2022 in Ethiopia). Column 1 displays the mean and standard deviations for the full sample, while columns 2-4 show them by subsample divided into the magnitude of reduction in small ruminants: sharp reduction (>.75), moderate reduction (<=.75), and no reduction. Columns 5-7 illustrate the pairwise differences with statistical differences between categories for each outcome. Data includes 742 of the 1179 households, excluding households without household members who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table C8: Herd composition large versus small ruminants - short-run and long-run

| | N of animals (CMVE) / Total herd size (CMVE) | | | |
|---|---|---|---|---|
| | Large | | Small | |
| | End of experiment | 10-year long-run | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) |
| Any insurance purchased | 0.062 | 0.209* | -0.062 | -0.209* |
| | (0.064) | (0.112) | (0.064) | (0.112) |
| Controls | ✓ | ✓ | ✓ | ✓ |
| Control mean | 0.616 | 0.566 | 0.384 | 0.434 |
| Complier mean | 0.657 | 0.618 | 0.343 | 0.382 |
| Observations | 1069 | 987 | 1069 | 987 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on herd composition at three time periods: (i) after the end of the experiment (sixth sales season) and (ii) at the 10-year follow up. The dependent variable "herd composition" is measured as the number of large animals vs. small animals, respectively, that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes sub population of the 1179 households excluding households that are not herding the livestock. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table C9: Livestock holdings large versus small ruminants - short-run and long-run

| | Number of animals (CMVE) | | | |
|---|---|---|---|---|
| | Large | | Small | |
| | End of experiment | 10-year long-run | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) |
| Panel A: All samples | | | | |
| Any insurance purchased | -0.156 | 6.316 | -1.511 | -0.865 |
| | (2.716) | (4.447) | (1.141) | (1.094) |
| Controls | ✓ | ✓ | ✓ | ✓ |
| Control mean | 10.888 | 9.185 | 4.611 | 3.617 |
| Complier mean | 12.634 | 9.385 | 4.222 | 2.618 |
| Observations | 1151 | 1179 | 1151 | 1179 |
| Panel B: Bottom 2/3 of baseline TLU | | | | |
| Any insurance purchased | -0.601 | -2.007 | -2.797* | -2.591* |
| | (2.890) | (5.069) | (1.438) | (1.541) |
| Controls | ✓ | ✓ | ✓ | ✓ |
| Control mean | 9.440 | 9.968 | 4.288 | 3.915 |
| Complier mean | 9.305 | 6.497 | 3.830 | 2.213 |
| Observations | 767 | 790 | 767 | 790 |
| Panel C: Top 2/3 of baseline TLU | | | | |
| Any insurance purchased | -1.546 | 13.827* | 0.498 | 1.666 |
| | (5.315) | (7.819) | (2.057) | (1.583) |
| Controls | ✓ | ✓ | ✓ | ✓ |
| Control mean | 14.471 | 6.986 | 5.410 | 2.779 |
| Complier mean | 19.006 | 15.046 | 4.972 | 3.412 |
| Observations | 384 | 389 | 384 | 389 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on herd composition at three time periods: (i) after the end of the experiment (sixth sales season) and (ii) at the 10-year follow up. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variable "Number of animals" is measured as the number of large animals vs. small animals, respectively, that the household herds expressed in CMVE. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table C10: Education outcomes —short-run and long-run

| | Maximum years of education | | Total years of education | | Average years of education | |
|---|---|---|---|---|---|---|
| | End of experiment | 10-year long-run | End of experiment | 10-year long-run | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Panel A: All samples | | | | | | |
| Any insurance purchased | -0.276 | 2.602* | 0.168 | 6.846* | 0.139 | 2.368* |
| | (0.575) | (1.488) | (0.834) | (3.594) | (0.213) | (1.238) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 2.119 | 7.255 | 2.814 | 13.275 | 0.639 | 5.296 |
| Complier mean | 1.613 | 7.123 | 2.655 | 12.746 | 0.769 | 5.592 |
| Observations | 1048 | 742 | 1048 | 742 | 1048 | 742 |
| Panel B: Baseline TLUs bottom 2/3 | | | | | | |
| Any insurance purchased | 0.211 | 5.464** | 0.701 | 14.516** | 0.306 | 5.110** |
| | (0.640) | (2.310) | (0.953) | (5.722) | (0.272) | (2.101) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 1.262 | 6.917 | 1.857 | 11.528 | 0.483 | 5.051 |
| Complier mean | 1.395 | 7.147 | 2.194 | 13.562 | 0.688 | 5.552 |
| Observations | 690 | 484 | 690 | 484 | 690 | 484 |
| Panel C: Baseilne TLUs top 1/3 | | | | | | |
| Any insurance purchased | -0.308 | -2.176 | 0.608 | -5.143 | 0.173 | -0.369 |
| | (1.036) | (2.486) | (1.517) | (5.383) | (0.367) | (1.765) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 4.235 | 8.067 | 5.176 | 17.467 | 1.023 | 5.884 |
| Complier mean | 2.018 | 7.077 | 3.512 | 11.231 | 0.919 | 5.666 |
| Observations | 358 | 258 | 358 | 258 | 358 | 258 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on pre-specified education outcomes at three time periods: i) after the third sales season, ii) after the end of the experiment (sixth sales season), and iii) at the 10-year follow up. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes subpopulation of households which have children who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep. Please refer to Table 1 for the definition of outcome variables.

Table C11: Payout effect on livestock holdings

| | Number of animal type / Total number of animals (CMVE) | | Number of animals (CMVE) | |
|---|---|---|---|---|
| | Large | Small | Large | Small |
| | (1) | (2) | (3) | (4) |
| Panel A: All samples | | | | |
| Predicted insurance purchase ($\gamma_1$) | 0.126 | -0.126 | 4.617 | -0.837 |
| | (0.125) | (0.125) | (4.968) | (1.313) |
| Predicted insurance purchase × Number of shocks ($\gamma_2$) | 0.135 | -0.135 | 7.098 | 1.234 |
| | (0.288) | (0.288) | (7.178) | (1.251) |
| Number of shocks ($\gamma_3$) | -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 |
| Panel B: Bottom 2/3 of baseline TLU | | | | |
| Predicted insurance purchase ($\gamma_1$) | 0.132 | -0.132 | -4.835 | -2.954* |
| | (0.154) | (0.154) | (5.293) | (1.601) |
| Predicted insurance purchase × Number of shocks ($\gamma_2$) | 0.0681 | -0.0681 | 5.414 | 2.295* |
| | (0.327) | (0.327) | (6.173) | (1.339) |
| Number of shocks ($\gamma_3$) | -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 |
| Panel C: Top 1/3 of baseline TLU | | | | |
| Predicted insurance purchase ($\gamma_1$) | 0.0872 | -0.0872 | 21.21** | 3.786 |
| | (0.228) | (0.228) | (10.52) | (2.366) |
| Predicted insurance purchase × Number of shocks ($\gamma_2$) | 0.469 | -0.469 | 29.30 | -0.373 |
| | (0.669) | (0.669) | (29.93) | (3.528) |
| Number of shocks ($\gamma_3$) | -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 |

Notes: : The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons and the predicted receipt of indemnity payments, instrumented by the number of discount coupons received in the first three seasons and its interaction with the exogenous number of times the index was triggered in the initial three seasons within the given index unit on herd composition outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-4 are the number of animals expressed in CMVE. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the household-level, as this was the level of randomization. The row labeled 'Coef: $\gamma_1 + \gamma_2$' displays the overall effects of the payout, and the row labeled '*p-value*' shows its statistical significance. The row labeled 'Coef: $\gamma_2 + \gamma_3$' displays the effects of the shock for those who received payouts, and the row labeled '*p-value*' shows its statistical significance. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes sub population of households excluding households that are not currently herding any livestock. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table C12: Payout effect on education outcomes

| | Of household members who were school-aged during the experiment | | |
|---|---|---|---|
| | Maximum years of education | Total years of education | Average years of education |
| | (1) | (2) | (3) |
| Panel A: All samples | | | |
| Predicted insurance purchase ($\gamma_1$) | 4.086** | 9.942** | 3.776*** |
| | (1.661) | (4.186) | (1.327) |
| Predicted insurance purchase × Number of shocks ($\gamma_2$) | -0.176 | 2.636 | -4.786 |
| | (3.539) | (6.066) | (3.254) |
| Number of shocks ($\gamma_3$) | -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 |
| Panel B: Bottom 2/3 of baseline TLU | | | |
| Predicted insurance purchase ($\gamma_1$) | 7.180*** | 18.50*** | 6.610*** |
| | (1.961) | (5.293) | (1.586) |
| Predicted insurance purchase × Number of shocks ($\gamma_2$) | -2.548 | -5.768 | -5.976 |
| | (3.916) | (6.646) | (3.646) |
| Number of shocks ($\gamma_3$) | 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 C: Top 1/3 of baseline TLU | | | |
| Predicted insurance purchase ($\gamma_1$) | -2.794 | -7.961 | -1.293 |
| | (3.155) | (6.820) | (2.429) |
| Predicted insurance purchase × Number of shocks ($\gamma_2$) | 5.807 | 22.51 | -3.206 |
| | (6.946) | (14.01) | (6.194) |
| Number of shocks ($\gamma_3$) | -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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons and the predicted receipt of indemnity payments, instrumented by the number of discount coupons received in the first three seasons and its interaction with the exogenous number of times the index was triggered in the initial three seasons within the given index unit on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. The row labeled 'Coef: $\gamma_2 + \gamma_3$' displays the effects of the shock for those who received payouts, and the row labeled '*p-value*' shows its statistical significance. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 742 of the 1179 households, excluding households without household members who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

# D Pre-specified Outcomes

Table D1: Prespecified primary outcomes: Herd size, earnings, education

| | 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 |

Notes: The Table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on pre-specified primary outcomes. The dependent variable “herd size” is measured as the number of livestock herded by the household in CMVE, “annual household cash earnings” is measured as self-reported seasonal cash income sources and amounts earned for the four seasons including sales of livestock, sales of livestock products, sales of crops, casual labor, employment and salary labor, trading expressed in USD, and "Maximum years of education" is measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head’s years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 742 of the 1179 households, excluding households without household members who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep. Please refer to Table 1 for the definition of outcome variables.

Table D2: Prespecified 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) | (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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on pre-specified outcomes: herd composition. The dependent variable “herd composition” is measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head’s years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 987 of the 1179 households excluding households that are not currently herding any livestock. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table D3: Prespecified secondary outcomes

| | 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on pre-specified secondary outcomes. The dependent variable “herd management expenditure” is measured as the sum of the expenditure on water, fodder, supplementary feeding, and veterinary expenses over the past 12 months in USD, “milk income” is measured as the cash and in-kind income from milk expressed in USD, “livestock loss” is measured as the loss of livestock such as death expressed in CMVE, “distress sales” is measured as sales of livestock to cope with drought expressed in CMVE, specifically aggregating the number of animals across different types by their market values using the pooled average prices observed from all purchases and all sold animals, and “livestock sale” is measured as sales for livestock expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head’s years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 781 of the 1179 households for columns 7 and 8 excluding households who did not sell any animals. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table D4: Prespecified secondary outcomes: 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 | | Studying full-time | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Any insurance purchased | 0.033 | 0.036 | -0.966 | -0.936 | -0.491 | -0.550 | 0.437* | 0.423* |
| | (0.043) | (0.044) | (0.889) | (0.907) | (0.329) | (0.338) | (0.265) | (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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on pre-specified secondary outcomes. The dependent variable "IBLI uptake" is measured in two ways: whether or not a household took up the insurance in the last 12 months before the endline survey, or the number of animals insured in the last 12 months in CMVE, and children's time use as the share of children aged 5-17 who worked and studied full-time. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data for columns 5 to 10 report the estimated coefficients with 376 observations, which is due to the absence of this information in Kenyan sample at the endline. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

# E Robustness

Table E1: Long-run effects of catastrophic drought insurance on livestock holdings 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 (Baseline TLU) | All | All | All | All | Bottom 2/3 | Bottom 2/3 | Top 1/3 | Top 1/3 %-tile |
| 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on livestock holdings. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. We do not include control variables in this specification. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3), while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table E2: Long-run effects of catastrophic drought insurance on education 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: Bottom 2/3 of baseline TLU | | | |
| 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: Top 1/3 of baseline TLU | | | |
| 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 |

Notes: This table presents the estimated Local Average Treatment Effect (LATE) of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during the initial three periods of experiments, i.e., household members who are currently 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. The FDR adjusted $p$-values (q-values) are reported in square brackets for outcomes that were not pre-specified, calculated according to the sharpened process Anderson (2008). We do not include control variables in this specification. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 742 of the 1179 households, excluding households without household members who were school-aged during the experiment. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E3: Long-run effects of catastrophic drought insurance on child time use without control variables

| | Share of children in the household | |
|---|---|---|
| | Working | Study full-time |
| | (1) | (2) |
| Any insurance purchased | -0.491 | 0.437* |
| | (0.329) | (0.265) |
| Controls | | |
| Control mean | 0.553 | 0.159 |
| Complier mean | 0.464 | 0.221 |
| Observations | 376 | 376 |

Notes: This table presents the estimated Local Average Treatment Effect (LATE) of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons, on child time use outcomes. The dependent variables "Working " and "Studying full-time" were only measured at endline in Ethiopia, and represent the share of current children aged 5-17 in the household that are reported to be engaged in each activity. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. We do not include control variables in this specification. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 376 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E4: Long-run effects of catastrophic drought insurance on herd composition (Westfall-Young MHT)

| | 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 | 0.209 | -0.209 | 6.316 | -0.865 | -2.007 | -2.591 | 13.827 | 1.666 |
| | «0.147» | «0.147» | «0.275» | «0.547» | «0.147» | «0.147» | «0.147» | «0.147» |
| 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on herd composition. The dependent variables in columns 1 and 2 are the number of animals as a share of total household herd size. Columns 3-8 are numbers of large and small animals (in CMVE). Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. Community fixed effects are included as randomization was stratified at community level. Community fixed effects are included as randomization was stratified at community level. «» reports Westfall-Young stepdown adjusted p-values, which control the familywise error rate and allow for dependence amongst p-values. The row "Control Mean" reflects average outcomes for those who did not receive any coupons in the first three seasons. The row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3) of the baseline herd size distribution, while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E5: Long-run effects of catastrophic drought insurance on education (Westfall-Young MHT)

| | 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 | 2.906* | 7.314** | 2.520** |
| | «0.094» | «0.094» | «0.094» |
| Controls | ✓ | ✓ | ✓ |
| Control mean | 7.255 | 13.275 | 5.296 |
| Complier mean | 7.123 | 12.746 | 5.592 |
| Observations | 742 | 742 | 742 |
| Panel B: Bottom 2/3 of baseline TLU | | | |
| Any insurance purchased | 5.658** | 14.535** | 5.254** |
| | «0.051» | «0.051» | «0.051» |
| Controls | ✓ | ✓ | ✓ |
| Control mean | 6.917 | 11.528 | 5.051 |
| Complier mean | 7.147 | 13.562 | 5.552 |
| Observations | 484 | 484 | 484 |
| Panel C: Top 1/3 of baseline TLU | | | |
| Any insurance purchased | -2.143 | -4.744 | -0.411 |
| | «0.717» | «0.717» | «0.848» |
| Controls | ✓ | ✓ | ✓ |
| Control mean | 8.067 | 17.467 | 5.884 |
| Complier mean | 7.077 | 11.231 | 5.666 |
| Observations | 258 | 258 | 258 |

Notes: This table presents the estimated Local Average Treatment Effect (LATE) of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during the initial three periods of experiments, i.e., household members who are currently 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). The false discovery rate- adjusted *p*-values (q-values) are reported in square brackets for outcomes that were not pre-specified, calculated according to the sharpened process Anderson (2008). Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. Community fixed effects are included as randomization was stratified at community level. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes 742 of the 1179 households, excluding households without household members who were school-aged during the experiment. «» reports Westfall-Young stepdown adjusted p-values, which control the familywise error rate and allow for dependence amongst p-values. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E6: Effects on livestock holdings using all six seasons as instruments

| | 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 (Baseline TLU) | 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the six seasons, instrumented by the number of discount coupons received in the six seasons on herd composition. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table E7: Effects on education using all six seasons as instruments

| | 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: Bottom 2/3 of baseline TLU | | | |
| 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: Top 1/3 of baseline TLU | | | |
| 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 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in the six seasons, instrumented by the number of discount coupons received in the six seasons, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 742 of the 1179 households, excluding households without school-aged children meeting the criteria. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E8: Effects on child time use using all six seasons as instruments

| | Share of children in the household | |
|---|---|---|
| | Working | Studying full-time |
| | (1) | (2) |
| Any insurance purchased (in six sales seasons) | -0.703 | 0.577 |
| | (0.588) | (0.451) |
| Controls | ✓ | ✓ |
| Control mean | 0.575 | 0.000 |
| Complier mean | 0.468 | 0.224 |
| Observations | 376 | 376 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in the six seasons, instrumented by the number of discount coupons received in the six seasons, on child time use outcomes. The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 376 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E9: Effects on livestock holdings in season 1 on livestock holdings

| | 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 TLU) | 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in season 1, instrumented by the number of discount coupons received in season 1 on herd composition. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3), while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table E10: Effects of IBLI purchase in season 1 on education

| | 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: Bottom 2/3 of baseline TLU | | | |
| 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: Top 1/3 of baseline TLU | | | |
| 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 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1, instrumented by the number of discount coupons received in season 1, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 738 of the 1179 households, excluding households without school-aged children meeting the criteria. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E11: Effects of IBLI purchase in season 1 on child time use

| | Share of children in the household | |
|---|---|---|
| | Working | Studying full-time |
| | (1) | (2) |
| Any insurance purchased – season 1 | -0.100 | 0.045 |
| | (0.186) | (0.146) |
| Controls | ✓ | ✓ |
| Control mean | 0.481 | 0.223 |
| Complier mean | 0.465 | 0.215 |
| Observations | 365 | 365 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1, instrumented by the number of discount coupons received in season 1, on child time use outcomes. The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons.Data includes 365 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E12: Effects on livestock holdings in season 1-2 on livestock holdings

| | 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 TLU) | 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in season 1-2, instrumented by the number of discount coupons received in season 1-2 on herd composition. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3), while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table E13: Effects of IBLI purchase in season 1-2 on education

| | 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: Bottom 2/3 of baseline TLU | | | |
| 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: Top 1/3 of baseline TLU | | | |
| 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 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1-2, instrumented by the number of discount coupons received in season 1-2, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 738 of the 1179 households, excluding households without school-aged children meeting the criteria. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E14: Effects of IBLI purchase in season 1-2 on child time use

| | Share of children in the household | |
|---|---|---|
| | Working | Studying full-time |
| | (1) | (2) |
| Any insurance purchased – from season 1 to 2 | -0.542 | 0.278 |
| | (0.383) | (0.251) |
| Controls | ✓ | ✓ |
| Control mean | 0.568 | 0.228 |
| Complier mean | 0.443 | 0.231 |
| Observations | 365 | 365 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1-2, instrumented by the number of discount coupons received in season 1-2, on child time use outcomes. The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 365 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E15: Effects on livestock holdings in season 1-4 on livestock holdings

| | 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 TLU) | 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in season 1-4, instrumented by the number of discount coupons received in season 1-4 on herd composition. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3), while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table E16: Effects of IBLI purchase in season 1-4 on education

| | 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 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1-4, instrumented by the number of discount coupons received in season 1-4, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 738 of the 1179 households, excluding households without school-aged children meeting the criteria. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E17: Effects of IBLI purchase in season 1-4 on child time use

| | Share of children in the household | |
|---|---|---|
| | Working | Studying full-time |
| | (1) | (2) |
| Any insurance purchased – from season 1 to 4 | -1.237 | 0.564 |
| | (1.603) | (0.947) |
| Controls | ✓ | ✓ |
| Control mean | . | . |
| Complier mean | 0.475 | 0.212 |
| Observations | 365 | 365 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1-4, instrumented by the number of discount coupons received in season 1-4, on child time use outcomes. The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 376 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E18: Effects on livestock holdings in season 1-5 on livestock holdings

| | 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 TLU) | All | All | All | All | Bottom 2/3 | Bottom 2/3 | Top 1/3 | Top 1/3 |
| 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in season 1-5, instrumented by the number of discount coupons received in season 1-5 on herd composition. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table E19: Effects of IBLI purchase in season 1-5 on education

| | 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: Bottom 2/3 of baseline TLU | | | |
| 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: Top 1/3 of baseline TLU | | | |
| 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 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1-5, instrumented by the number of discount coupons received in season 1-5, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 738 of the 1179 households, excluding households without school-aged children meeting the criteria. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E20: Effects of IBLI purchase in season 1-5 on child time use

| | Share of children in the household | |
|---|---|---|
| | Working | Studying full-time |
| | (1) | (2) |
| Any insurance purchased – from season 1 to 5 | -0.941 | 0.041 |
| | (1.082) | (0.515) |
| Controls | ✓ | ✓ |
| Control mean | . | . |
| Complier mean | 0.474 | 0.221 |
| Observations | 365 | 365 |

Notes: This table presents the estimated Local Average Treatment Effect of any insurance purchase in season 1-5, instrumented by the number of discount coupons received in season 1-5, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in all the six seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in all the six seasons. Data includes 738 of the 1179 households, excluding households without school-aged children meeting the criteria. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E21: Effects on livestock holdings with the 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 (Baseline TLU) | 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 |

Notes: The table presents estimated Local Average Treatment Effects of the number of insurance purchase in the initial three seasons, instrumented by the number of discount coupons received in the initial three seasons seasons on livestock holdings. The dependent variables in columns 1 and 2 are measured as the number of animals of each animal type that the household herds expressed in CMVE divided by the total number of animals that the household herds expressed in CMVE while the ones in columns 3-8 are the number of animals expressed in CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Columns 1–2 exclude households that do not herd any livestock. Columns 3–4 represent the full sample. Columns 5–6 examine households whose baseline TLU quantile was at or below the bottom one-third (1/3), while Columns 7–8 focus on those above the bottom two-thirds (2/3). * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

Table E22: Effects on education with the 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: Bottom 2/3 of baseline TLU | | | |
| 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: Top 1/3 of baseline TLU | | | |
| 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 |

Notes: This table presents the estimated Local Average Treatment Effect of the number of insurance purchase in the initial three seasons, instrumented by the number of discount coupons received in the initial three seasons seasons, on education outcomes. Panel A shows the effects for all sample households, Panel B for those with herd sizes below 20 TLU at baseline (the lowest 67% of observations based on the baseline herd size distribution), and Panel C for those with herd sizes above 20 TLU (the highest 33% of observations based on the baseline herd size distribution). The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. Data includes 742 of the 1179 households, excluding households without school-aged children meeting the criteria. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E23: Effects on child time use with the number of IBLI as the endogenous variable

| | Share of children in the household | |
|---|---|---|
| | Working | Studying full-time |
| | (1) | (2) |
| N. of IBLI purchased | -0.477 | 0.353 |
| | (0.300) | (0.216) |
| Controls | ✓ | ✓ |
| Control mean | 0.575 | 0.000 |
| Complier mean | 0.468 | 0.224 |
| Observations | 376 | 376 |

Notes: This table presents the estimated Local Average Treatment Effect of the number of insurance purchase in the initial three seasons, instrumented by the number of discount coupons received in the initial three seasons seasons, on child time use outcomes. The dependent variables "Maximum years of education", "Total years of education", and "Average years of education" are measured among household members who were school-aged at any point during initial three periods of experiments, i.e., 15-29 years old in Kenya and 15-17 years old in Ethiopia (data in Ethiopia is limited to those up to 17 years old). Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. Data includes 376 of the 1179 households, excluding households without household members who were school-aged during the experiment (only available in Ethiopia). The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E24: Long-run effects of catastrophic drought insurance on migration and sedentary

| | 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 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on migration and sedentary. The dependent variables are whether the household is fully settled, whether the household has any satellite camp to feed livestock currently, and plant any crops during gana and hagaiya. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. The data in Column 1 includes 1179 households and the rest is available only for Ethiopian samples (= 398). Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. Baseline outcome is available only for fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

# F Comparing outcomes in TLU versus CMVE

In the analysis above, we used cattle market-value equivalent (CMVE) to aggregate the number of animals across animal species, instead of tropical livestock unit (TLU) that are typically used as a measure of the value of livestock assets. Since CMVE is a new aggregation unit to be us ed, we also construct variables in TLU i) to confirm that the values in CMVE is reasonable, and ii) to run the same estimations again with variables in TLU to check if the results are robust to changes in aggregation units.

Table F1 shows that our findings in the previous section regarding the herd sizes are robust to the changes in the unit of aggregation. The results are consistent with the results using CMVE measure in terms of sign, magnitude, and statistical significance, as expected. Note that the pattern for the composition for each country is also consistent. We confirm all the null results on TLU lost, TLU distress sales, TLU sold, and recent purchase of IBLI in the last 12 months window.

We also present results from quantile regression, examining the effects from the 10th to the 90th percentile in increments of every 10 percentiles. Table H2 reveals that the estimated coefficients are positive across all quantiles, and statistically significant at the 30th and 40th percentiles. This suggests that IBLI mechanically increases herd size at lower-middle quantiles. It is noteworthy that only 37% of the sample households maintained their original herd size quartile until the endline.

Table F1: Effects on livestock measured by TLU

| | | N of animal type in TLU / Total N of animals in TLU | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Herd size | Camel | Cattle | Goat | Sheep | Livestock loss | Distress sales | Sold | IBLI purchase (in the last 12 months) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Any insurance purchased | 2.434 | 0.091 | 0.122 | -0.214** | 0.004 | 0.352 | -0.387 | -1.276 | -0.491 |
| | (8.181) | (0.085) | (0.080) | (0.092) | (0.050) | (2.480) | (0.483) | (1.402) | (0.533) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 13.736 | 0.242 | 0.341 | 0.280 | 0.137 | 5.296 | 0.381 | 2.453 | 0.182 |
| Complier mean | 12.500 | 0.179 | 0.459 | 0.266 | 0.096 | 4.889 | 0.737 | 1.907 | 0.407 |
| Observations | 1179 | 987 | 987 | 987 | 987 | 1124 | 781 | 1131 | 1179 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on livestock related outcomes measured by TLU, instead of CMVE. The dependent variables are herd size, share of livestock, livestock loss, distress sales, livestock sold, and IBLI purchase in the last 12 months. “Herd composition” is measured as the number of animals of each animal type that the household herds expressed in TLU divided by the total number of animals that the household herds expressed in TLU. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head’s years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. The row "Control Mean" indicates the average outcomes for those who did not receive any coupons in the first three seasons, while the row "Complier Mean" indicates the average outcomes for those who purchased any insurance in the first three seasons. Data includes subpopulation of households of the 1179 households excluding households that are not having livestock outcomes. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. Tropical Livestock Unit (TLU) is an integrated unit for aggregating cattle, camel, sheep, and goats by typical live body weight. 1 TLU = 0.7 Camel = 1 Cattle = 10 Sheep/goats. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.

# G Construction of income variables

Capturing income in this context is challenging due to the predominance of in-kind income sources. This section explains how we refined income variables in a reasonable manner. First, we aim to capture the overall income by considering all possible relevant sources, such as food-for-work employment programs. Second, we refine each income variable to include not only cash sales but also 'in-kind' income. For instance, we value the total produced milk (not just the amount sold) at the selling price. Finally, we try to reduce the measurement errors due to outliers.

We provide detailed definitions and describe our approach to imputing values, where necessary, to construct our income variables. The overarching strategy is to identify sources of in-kind income and calculate total income using reported amounts and available prices. To mitigate the impact of extreme values and reporting errors, we opt for the median price within the same location, type, or season/year, rather than relying on raw self-reported prices. For each livelihood activity, we compare reported earnings with total calculated in-kind income, typically expecting in-kind income to equal or exceed earnings. However, inaccuracies due to recall errors or typos may lead to discrepancies. In cases of inconsistency, we prioritize reported earnings over in-kind calculations due to their reliability (e.g., if reported total milk earnings are $1,000 and calculated total in-kind is $2,000, we use $2,000 as the total milk income; if total earnings are $1,000 and total in-kind is $ 500, we use $1,000).

To standardize data across the two countries, we normalize values using exchange rates, converting all amounts to USD. The conversion rates applied are KES/USD = 106.45 in 2020 and ETB/USD = 51.952 in 2022 for endline, and KES/USD = 77.35 in 2009 and ETB/USD = 17.70 in 2012 for baseline.

Here are the list of pre-specified income, annual total household cash earnings and annual milk income.

- "Annual total household cash earnings" (Pre-specified): defined as self-reported seasonal main income sources and amounts earned for the four seasons starting with the most recent dry and rainy seasons (e.g., sales of livestock, sales of livestock products, sales of crops, casual labor, employment and salary labor, trading, etc). We windsorize the earnings within round at the 99th percentile for analysis.
- "Annual milk income (earnings and in-kind)" (pre-specifed): defined as the income from milk (production including both sold and in-kind). The price is evaluated by the sold price using median within animal type, sublocation, season, and round. We windsorize size of

container and number of containers within round, animal type, and season at the 99th percentile for analysis. We replace income = earnings if income < earnings. This will be decomposed into in-kind and earnings.

The lists below is the total household income, and those used to construct that variable (mutually exclusive).

- "Annual total household income": defined as the aggregate sum of cash earnings and all other forms of in-kind income, including cash earnings, income from milk, crops, slaughter animals, animal births, and employment (such as food for work).
- "Annual animal birth income": is defined as in-kind income from animals born. The value is evaluated at the 20% of median sold price of adult animals within animal type and rounds. We widsornize number of animals birth within animal type and rounds at the 99th percentile for analysis.
- "Annual employment (food for work) income": is defined as the income from food for work employment program both in-kind and cash by the cash equivalent value. We use the median daily rate within sublocation and rounds. We windsornize number of days worked within round and sublocation at the 99th percentile for analysis.
- "Annual crop income": is defined as income from crop (harvest including both sold and in-kind). The price is evaluated at the median price within crop type and round. The quantity (kg) is windsroize by round. We replace income = earnings if income < earnings. We decompose it into in-kind and earnings to avoid double counting.[34]
- "Annual slaughter income incl. earnings": is defined as the in-kind income from slaughtered animals. The value is evaluated at the sold price of slaughtered animals if available, otherwise at the sold price.[35] If the price is missing, we use the median of sold price within sublocation, animal type, and season. We windsornize number of animals slaughtered by round at the 99th percentile for analysis.. We replace income = earnings if income < earnings.[36] We decompose it into in-kind and earnings to avoid double counting.

[34] We do not have information of in-kind in round 1.

[35] We restrict slaughter income for consumption and celebration, but due to data limitation we include all slaughter at R5 in Ethiopia.

[36] Due to data limitation, we bound it by earnings from slaughtered meat in Kenya, but by earnings from sale of livestock product in Ethiopia.

- " Annual earnings from the rest": is defined as annual total household cash earnings minus earnings from crop and slaughter. This is defined just to avoid double counting. This includes casual labor, employment and salary labor, trading, etc).

Appendix Table G1 and G2 provide summary statistics of income variables and their baseline, respectively. The annual total household income averages USD 1293.43 for Kenya, with a standard deviation (SD) of 1805.24, highlighting significant income variation. Ethiopia's mean total household income is lower at USD 770.89, with an SD of 904.29, suggesting a comparably diverse range of income. Focusing on cash earnings (pre-specified outcome), Kenyan households have an average of USD 515.08 with an SD of 671.37, while Ethiopian households show a mean of USD 564.31. Milk income (pre-specified outcomes) stands at a mean of USD 540.99 with an SD of 1,361.23 in Kenya. In contrast, Ethiopia reports a substantially lower mean of USD 85.18 and an SD of USD 246.72. The mean annual crop income is around UDSD 30-40. Slaughter income, indicative of revenue from the sale of livestock for meat, has roughly a mean of USD 70. The annual animal birth income averages USD 145. The baseline outcomes, capturing the initial state of these variables, mirror the current.

Table G1: Summary statistics of the income variables

| | Kenya | | | | Ethiopia | | | | Pooled | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs |
| ***Pre-specified outcomes*** | | | | | | | | | | | | |
| Annual total household cash earning (USD) | 515.08 [671.37] | 0.00 | 5636.45 | 781 | 564.31 [597.82] | 0.00 | 3649.52 | 398 | 531.70 [647.64] | 0.00 | 5636.45 | 1179 |
| Annual milk income (USD) (earnings and in-kind) | 540.99 [1361.23] | 0.00 | 21957.05 | 781 | 111.00 [634.35] | 0.00 | 11895.60 | 398 | 395.84 [1184.86] | 0.00 | 21957.05 | 1179 |
| ***Exclusive categories*** | | | | | | | | | | | | |
| Annual total household income (USD) | 1293.43 [1805.24] | 0.00 | 22689.29 | 781 | 763.23 [894.42] | 0.00 | 9333.62 | 398 | 1114.45 [1578.09] | 0.00 | 22689.29 | 1179 |
| Annual animal birth income (USD) | 159.93 [472.62] | 0.00 | 7589.79 | 781 | 96.06 [365.90] | 0.00 | 5292.39 | 398 | 138.37 [440.38] | 0.00 | 7589.79 | 1179 |
| Annual employment (food for work) income (USD) | 1.32 [8.36] | 0.00 | 147.96 | 781 | 5.33 [43.47] | 0.00 | 649.64 | 398 | 2.67 [26.21] | 0.00 | 649.64 | 1179 |
| Annual in-kind crop income (USD) | 12.40 [68.85] | 0.00 | 995.77 | 781 | 17.08 [90.95] | 0.00 | 962.43 | 398 | 13.98 [77.01] | 0.00 | 995.77 | 1179 |
| Annual earnings from crop (USD) | 15.49 [116.13] | 0.00 | 1972.76 | 781 | 18.45 [72.96] | 0.00 | 750.69 | 398 | 16.49 [103.56] | 0.00 | 1972.76 | 1179 |
| Annual in-kind milk income (USD) | 137.60 [1002.75] | 0.00 | 18970.03 | 781 | 74.48 [216.54] | 0.00 | 2125.04 | 398 | 116.29 [826.12] | 0.00 | 18970.03 | 1179 |
| Annual sales from milk (USD) | 403.39 [613.90] | 0.00 | 4154.44 | 781 | 3.05 [14.34] | 0.00 | 136.43 | 398 | 268.25 [534.30] | 0.00 | 4154.44 | 1179 |
| Annual in-kind slaughter income (USD) | 63.71 [148.58] | 0.00 | 2367.31 | 781 | 2.93 [19.76] | 0.00 | 254.45 | 398 | 43.19 [124.80] | 0.00 | 2367.31 | 1179 |
| Annual earnings from slaughter (USD) | 10.22 [67.15] | 0.00 | 1127.29 | 781 | 54.56 [199.41] | 0.00 | 1539.88 | 398 | 25.19 [129.72] | 0.00 | 1539.88 | 1179 |
| Annual earnings from the rest (USD) | 489.38 [664.12] | 0.00 | 5636.45 | 781 | 491.30 [500.31] | 0.00 | 2221.28 | 398 | 490.02 [613.51] | 0.00 | 5636.45 | 1179 |
| Observations | 781 | | | | 398 | | | | 1179 | | | |

Notes: The first two rows display our pre-specified income-related variables. The annual total household income represents the sum of all mutually exclusive categories for each component of income listed below. The currency is converted to USD using the exchange rates: KES/USD = 106.45 in 2020 and ETB/USD = 51.952 in 2022.

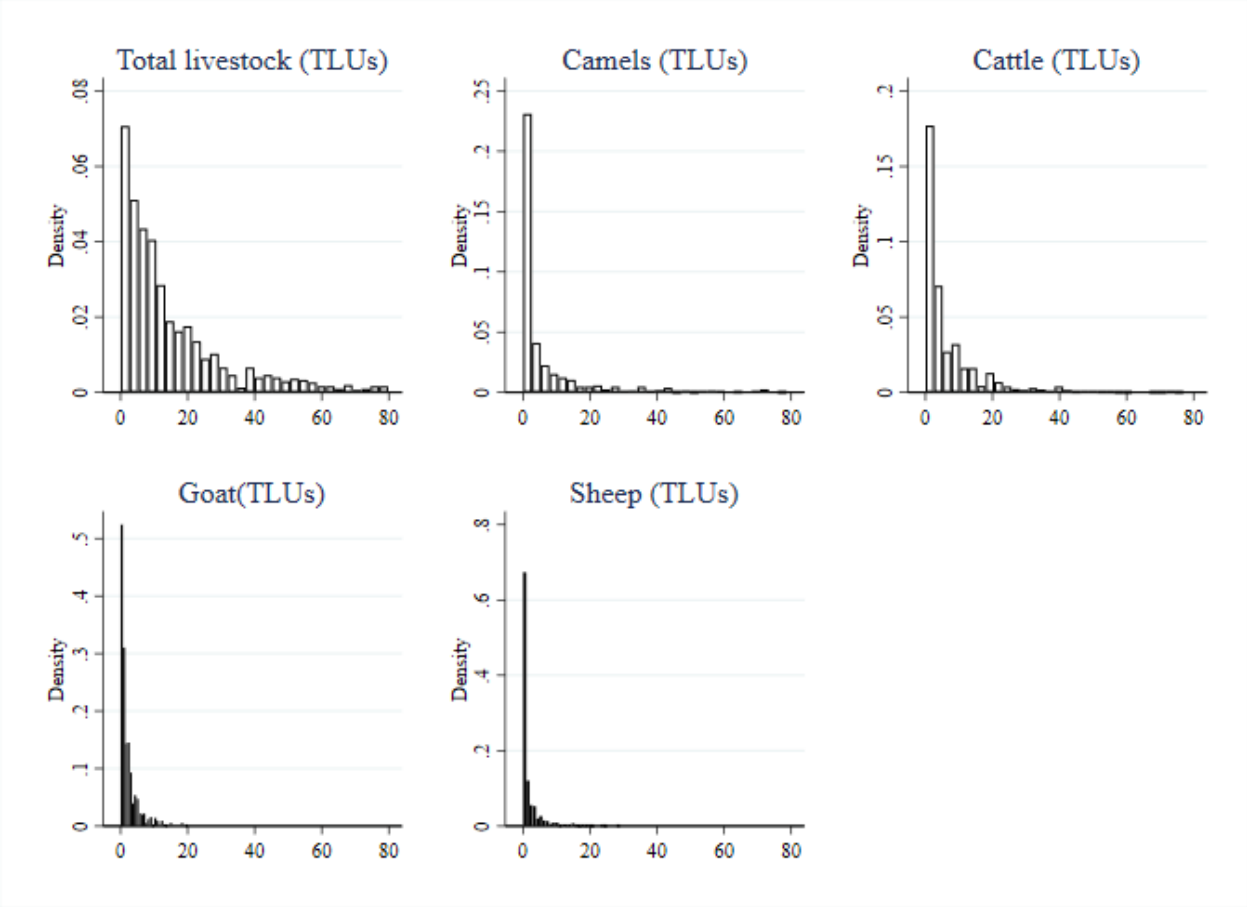
Table G2: Summary statistics of the baseline income variables

| | Kenya | | | | Ethiopia | | | | Pooled | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs |
| ***Baseline pre-specified outcomes*** | | | | | | | | | | | | |
| Baseline Annual household cash earnings (USD) | 516.55 [828.25] | 0.00 | 6877.83 | 781 | 462.92 [594.14] | 0.00 | 5423.73 | 398 | 498.44 [757.52] | 0.00 | 6877.83 | 1179 |
| Baseline annual milk income (USD) (earnings and in-kind) | 886.09 [1668.25] | 0.00 | 12192.44 | 781 | 161.81 [265.31] | 0.00 | 2496.61 | 398 | 641.59 [1408.51] | 0.00 | 12192.44 | 1179 |
| ***Baseline exclusive categories*** | | | | | | | | | | | | |
| Baseline annual total household income (USD) | 1570.40 [2038.94] | 0.00 | 16205.37 | 781 | 768.62 [829.83] | 4.52 | 9820.90 | 398 | 1299.74 [1768.79] | 0.00 | 16205.37 | 1179 |
| Baseline annual animal birth income (USD) | 130.64 [210.53] | 0.00 | 2053.01 | 781 | 58.98 [103.70] | 0.00 | 1107.34 | 398 | 106.45 [184.72] | 0.00 | 2053.01 | 1179 |
| Baseline annual employment (food for work) income (USD) | 5.24 [57.25] | 0.00 | 1120.88 | 781 | 50.67 [82.32] | 0.00 | 424.86 | 398 | 20.58 [70.11] | 0.00 | 1120.88 | 1179 |
| Baseline annual in-kind crop income (USD) | 0.00 [0.00] | 0.00 | 0.00 | 781 | 0.00 [0.00] | 0.00 | 0.00 | 398 | 0.00 [0.00] | 0.00 | 0.00 | 1179 |
| Baseline annual earnings from crop (USD) | 14.41 [138.19] | 0.00 | 2262.44 | 781 | 14.28 [48.33] | 0.00 | 406.78 | 398 | 14.36 [115.90] | 0.00 | 2262.44 | 1179 |
| Baseline annual in-kind milk income (USD) | 862.22 [1650.77] | 0.00 | 12192.44 | 781 | 154.84 [261.03] | 0.00 | 2496.61 | 398 | 623.43 [1392.59] | 0.00 | 12192.44 | 1179 |
| Baseline annual sales from milk (USD) | 23.87 [54.27] | 0.00 | 437.17 | 781 | 4.78 [18.41] | 0.00 | 146.61 | 398 | 17.43 [46.33] | 0.00 | 437.17 | 1179 |
| Baseline annual in-kind slaughter income (USD) | 31.88 [56.82] | 0.00 | 840.34 | 781 | 36.44 [95.45] | 0.00 | 793.22 | 398 | 33.42 [72.20] | 0.00 | 840.34 | 1179 |
| Baseline annual earnings from slaughter (USD) | 5.14 [82.39] | 0.00 | 2262.44 | 781 | 5.34 [22.84] | 0.00 | 216.50 | 398 | 5.21 [68.34] | 0.00 | 2262.44 | 1179 |
| Baseline annual earnings from the rest (USD) | 497.00 [814.35] | 0.00 | 6877.83 | 781 | 443.31 [594.36] | 0.00 | 5423.73 | 398 | 478.88 [747.54] | 0.00 | 6877.83 | 1179 |
| Observations | 781 | | | | 398 | | | | 1179 | | | |

Notes: The first two rows display our pre-specified income-related variables. The annual total household income represents the sum of all mutually exclusive categories for each component of income listed below. The currency is converted to USD using the exchange rates: KES/USD = 77.35 in 2009 and ETB/USD = 17.70 in 2012.

# H Additional Tables and Figures Referenced in Text

Figure H1: Histogram of baseline livestock holdings




Notes: These figures show the number of livestock holdings for total and each animal species, evaluated by TLUs. Each variable is scaled from 0-80. 1 TLU = 0.7 Camel = 1 Cattle = 10 Sheep/goats.

Table H1: The average market values of animals

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **Marsabit, Kenya** | | | **Borana, Ethiopia** | | |
| | KES | Cattle Equivalent | Data Rounds | Birr | Cattle Equivalent | Data Rounds |
| **Camel** | 25,132 | 1.6 | 1-7 | 7,447 | 2.5 | 1-4 |
| **Cattle** | 15,617 | 1.0 | 1-7 | 3,023 | 1.0 | 1-4 |
| **Sheep** | 1,515 | 0.1 | 7 | | | |
| **Goats** | 1,561 | 0.1 | 7 | | | |
| **Sheep or Goat** | 2,308 | 0.15 | 1-6 | 484 | 0.16 | 1-4 |

Note: The table presents the market value of each species across during our study periods. Columns 1 and 4 show the value of each species in local currencies (KES for Kenya, Birr for Ethiopia). Columns 2 and 5 show values relative to the cattle equivalent (with cattle value set to 1 in each country). Columns 3 and 6 indicate the rounds of data collection during which these animals' market values were recorded.

Table H2: Effects on herd size at different quantile in endline

| | 10th %-tile | 20th %-tile | 30th %-tile | 40th %-tile | 50th %-tile | 60th %-tile | 70th %-tile | 80th %-tile | 90th %-tile |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Any insurance purchased | 1.274 | 2.014 | 2.840* | 3.623* | 5.228 | 5.074 | 7.278 | 7.409 | 5.680 |
| | (1.279) | (1.494) | (1.659) | (1.974) | (4.454) | (4.320) | (12.114) | (9.843) | (14.730) |

Notes: The table presents estimated IV quantile regression of any insurance purchase in the first three seasons, instrumented by the number of discount coupons received in the first three seasons on total livestock size measured by CMVE. Community fixed effects are included as randomization was stratified at community level. Standard errors are clustered at the household-level, as this was the level of randomization. Data includes households of the 1179 households excluding households that are not having livestock outcomes. Our control variables are the pre-specified balance variables presented in Table 1 and are: age of household head in years, whether the household is a male headed household, the household head's years of education, adult equivalent, dependency ratio, herd size in CMVE, annual income per adult equivalent in USD, whether the household owns or farms agricultural land, and is fully settled. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=0.4 camel=1 cattle=6.25 goats/sheep.