# Long-run Effects of Catastrophic Drought Insurance*

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**Abstract**

Aggregate shocks such as droughts and other natural disasters can have negative long-run impacts on various well-being indicators. Formal insurance against covariate shocks offers a tool to mitigate these negative consequences. We study the long-run impacts of catastrophic drought insurance – first introduced in 2010 – on pastoralists in Kenya and Ethiopia. We leverage randomized insurance premium discounts distributed when insurance was first introduced to estimate the impact of insurance on outcomes measured 10 years later. Insurance induced change in production strategies, inducing a substantial increase in the herd share of larger animals, such as camels and cattle, and a sharp decrease in smallstock like goats. Furthermore, we observe a substantial increase in the share of household members who completed age-appropriate education, seemingly resulting from both the herd composition shift - the marginal productivity of child labor is lower herding large animals than smallstock - and positive income effects. Reduced *ex ante* risk exposure and the behavioral change it induces – not the cash transfers resulting from the indemnity payment *ex post* of drought – generate the long-run effects we observe. The results are robust to controlling for prospective spillover effects among households.

*Keywords:* human capital, index insurance, livestock, pastoralists, production strategies,

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# 1 Introduction

Catastrophic aggregate shocks such as droughts and other natural disasters have negative long-run impacts on lifetime well-being, such as education, health, assets, and labor-market outcomes (Maccini and Yang, 2009; Dinkelman, 2017; Shah and Steinberg, 2017; Carrillo, 2020). First, exposure to disaster risk may discourage investment in income-generating assets that are vulnerable to catastrophic loss (Boucher, Carter, and Guirkinger, 2008; Karlan et al., 2014; Emerick et al., 2016). Second, when shocks occur, uninsured people may draw down productive assets and reduce human capital investment, with especially detrimental effects if that happens early in life (Jensen, 2000; Alderman, Hoddinott, and Kinsey, 2006). In the presence of multiple equilibrium poverty traps – which are shown to be more widespread than initially thought (Lybbert et al., 2004; Kraay and McKenzie, 2014; Banerjee et al., 2019; Barrett, Carter, and Chavas, 2019; Balboni et al., 2022) – there might not be any recovery if the disaster pushes the household into a low-level, poor equilibrium (Lybbert et al., 2004; Kraay and McKenzie, 2014; Banerjee et al., 2019; Barrett, Carter, and Chavas, 2019; Balboni et al., 2022). While the literature points to insurance market failures as an important source of the adverse impacts of catastrophic risk (Lybbert et al., 2004; Karlan et al., 2014; Barrett, Carter, and Chavas, 2019) evidence on the long-run impacts of insurance is lacking.

We present evidence of the 10-year, long-run effects on income, assets, production strategies, and human capital accumulation of an insurance product against catastrophic droughts, offered to pastoral households in the arid and semi-arid lands (ASAL) of northern Kenya and southern Ethiopia. We find that insurance uptake changed production strategies, inducing an increase in the share of large animals herded – camels and cattle – and a sharp reduction in smallstock, particularly goats. We observe sizeable but imprecisely estimated increases in livestock income, and significant

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increases in crop income. We do not observe changes in the total value of productive assets. But we do find a substantial and significant increase in the share of household members that completed age-appropriate education, from 12 percent in the control group to 28 percent for households with insurance. The herd composition and education impacts are closely linked. Children are far less likely to herd large animals, so induced herd composition changes reduce the marginal productivity of child herding labor, thereby creating incentives to send children to school that are magnified by the positive estimated income effects. We demonstrate that the long-run effects we observe arise from insurance coverage, not the receipt of indemnity payments. This suggests that reduced *ex ante* risk exposure and the behavioral change it induces – not the cash transfers resulting from the indemnity payments – generate the long-run effects we observe.

Investigating the long-run effects of insurance against aggregate shocks is complicated by the fact that most programs that offer insurance in low-income settings have been short-lived. Agricultural indemnity insurance is often fraught with moral hazard, adverse selection and high transaction costs, while index insurance products have typically remained at pilot scale due to low product quality and implementation challenges (Mobarak and Rosenzweig, 2013; Hill et al., 2019; Binswanger-Mkhize, 2012; Carter et al., 2017). A notable exception is the Index-Based Livestock Insurance (IBLI) program. 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, similar to most commercial insurance products worldwide. 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 (Chantarat et al., 2013). Since piloting in northern Kenya in 2010, IBLI has gradually expanded; as of December 2022, over 500,000 households in three countries (Ethiopia, Kenya, and Zambia) have been individually insured through IBLI (Jensen et al., 2024b). Recent initiatives by the governments of Kenya, Ethiopia, Djibouti and Somalia, supported by the World Bank, aim to scale IBLI further to reach 1.6 million pastoralists by 2025 (The World Bank, 2022).[1] Given that the program has been running for many years, and was originally introduced through an experiment with a panel household survey, IBLI uniquely allows for investigation of the long-run impacts of insurance against catastrophic droughts.

To investigate these long-run impacts, we conduct a 10-year follow-up panel survey with 82 percent of the original baseline sample from Kenya (in 2009) and Ethiopia (in 2012), immediately before IBLI became available in each location. We leverage the individual-level randomized distribution post-baseline of IBLI premium subsidies to 1,439 pastoralists from 33 locations in southern Ethiopia and northern Kenya during six sales seasons between 2010 and 2015. In each

[1]Beyond those four countries, IBLI is also employed for macro-scale sovereign drought insurance in Kenya and Mauritania. For more background details on IBLI, see Jensen et al. (2024b).

location, a random sample of individuals, stratified by herd size, was randomly assigned to receive premium discount coupons that were distributed just prior to the sales season. These 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 (TLUs).[2] After the baseline survey, panel surveys of the same households were then conducted annually for three rounds in Ethiopia and four rounds in Kenya, up to 2015. During the period 2009-2015, low NDVI readings triggered the drought index four times in Kenya and one time in Ethiopia, resulting in indemnity payments to current policyholders. No randomized premium discounts were provided nor were any surveys 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. Supply constraints limited the take-up of the insurance in our study communities after the experimental period (Jensen et al., 2024a).[3]

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 our pre-specified outcomes.[4] We causally identify the long-run impacts of any IBLI purchase, instrumenting insurance purchase in the first three sales seasons by the number of discount coupons received during that initial exposure period.[5] 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., education of household members), and were chosen because aggregate shocks have been demonstrated previously to negatively affect these outcomes. Our pre-specified secondary outcomes reflect short-run impacts initially observed in the IBLI pilot period: herd management expenditures, annual milk income (cash income only), livestock loss, distress sale of livestock, share of children working, as well as recent IBLI uptake.

The long-run effects of IBLI are striking. We observe a sharp shift in herd composition – an 83 percent reduction in the share of goats herded and a corresponding increase in larger animals, significant at the five percent level. We also find large but imprecisely estimated increases in total livestock income and significant increases in in-kind crop income. Furthermore, we find a

[2]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

[3]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 did not reliably offer IBLI in our study villages, even as they continued to sell IBLI elsewhere, where they had arranged and financed the last mile sales and outreach from 2010-15. Thus while IBLI has continued, even expanded overall since the study period, in our study villages it was effectively a temporary intervention prior to our 10-year follow up visits.

[4]See AEARCTR-0011184 at https://www.socialscienceregistry.org/trials/11184.

[5]This provides the strongest instrument while maintaining monotonicity of the relationship between the instrument and the endogenous regressor.

substantial increase in educational attainment, from a 12 percent completion rate of age-appropriate education in the control group to a 28 percent completion rate of age-appropriate education among insured households, significant at the five percent level. We also observe a tripling of the share of current children studying full time, from about 23 percent to 70 percent, significant at the ten percent level.

In contrast to these long-run effects, several statistically significant short-run effects of IBLI uptake that were found during the experiment period, on total herd size, herd management expenditures, livestock loss, distress sales of livestock, and IBLI purchases over the last 12 months (Jensen, Barrett, and Mude, 2017; Janzen and Carter, 2019; Matsuda, Takahashi, and Ikegami, 2019; Noritomo and Takahashi, 2020) do not replicate at this longer-run horizon. We also find no long-run effects on the total value of productive assets nor on total cash income.

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 that might affect and be affected by IBLI uptake – may violate our identification assumptions. Therefore we leverage exogenous variation across communities in discount coupons received by peers, to estimate potential spillovers in our first- and second-stage IV estimation as a robustness check on our core results. We find that our second-stage outcomes on education and herd composition remain robust, but the positive effect on whether or not children are studying full-time disappears and becomes insignificant.

We explore candidate mechanisms driving the long-run outcomes. We can rule out that IBLI uptake in the initial period during the experiment induced take-up ten years later. Supply constraints in our study villages precluded insurance take-up after the experiment. So the observed effects arise from transitory insurance exposure, as one might expect in a context previously shown to exhibit multiple equilibrium poverty traps (Lybbert et al., 2004; Barrett et al., 2006; Santos and Barrett, 2011; Santos and Barrett, 2019). We therefore investigate the dynamics of effects over time, running the same regressions on outcomes measured immediately after the third sales season ($\sim$ 1.5 years), as well as by the end of the experiment, after the sixth sales season ($\sim$ 3 years). The results show that the effect on herd composition materialized 1.5 years after the IBLI introduction, prior to the effect on educational attainment, and estimated .effects grew in magnitude after the experiment ended.

The herd composition and educational attainment effects are substantively linked, not just coincident in time. Larger species like camels and cattle generate greater income - e.g., milk, calves

- per TLU, yielding a positive income effect on educational investment. This herd composition change also reduces household demand for child labor because children are far less likely to herd camels or cattle than goats or sheep. This effect is especially pronounced for boys.

The observed effect on production strategies due to formal insurance coverage may have arisen due to reduced incentives to hold goats as precautionary savings[6] and increased incentives to invest in lumpy higher-risk but higher-return assets such as camels or cattle.[7] Such *ex ante* effects of insurance are well-documented in the literature (Cole and Xiong, 2017; Jensen, Barrett, and Mude, 2017; Hill et al., 2019; Stoeffler et al., 2022; Boucher et al., 2021).[8]

Consistent with those mechanisms, we investigate whether the long-run outcomes are indeed driven by *ex ante* behavioral effects induced by reduced catastrophic risk exposure resulting from purchasing insurance, or from *ex post* impacts of IBLI indemnity payments triggered by (exogenous) low NDVI readings during droughts. We demonstrate that reduced *ex ante* risk exposure and the behavioral change it induces, not the cash transfers resulting from the indemnity payment, generate the long-run effects we observe. This is consistent with prior findings of subjective well-being gains from IBLI coverage even in the absence of payouts (Tafere, Barrett, and Lentz, 2019), as well as *ex ante* effects of insurance that are found, 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).

We build on the literature on the long-run impacts of uninsured covariate weather shock exposure, which routinely finds negative effects on height (Alderman, Hoddinott, and Kinsey, 2006), education (Alderman, Hoddinott, and Kinsey, 2006; Maccini and Yang, 2009; Shah and Steinberg, 2017; Carrillo, 2020), health (Maccini and Yang, 2009; Dinkelman, 2017; Carrillo, 2020), assets (Maccini and Yang, 2009), and labor market outcomes (Carrillo, 2020). We demonstrate that insurance against catastrophic weather shocks has a positive effect on similar long-run outcomes through its *ex ante* effect on behavior. Our results are most consistent with an interpretation akin to Shah and Steinberg (2017), where insurance, by changing production strategies, has an indirect effect on the marginal productivity of child labor, changing incentives for children to remain in school. That effect is reinforced by the positive estimated income effects of IBLI uptake.

We also connect to a nascent literature on the long-run impacts of development interventions (see Bouguen et al. (2019) for a review). Most evidence comes from either studies of human

[6]Goats are typically 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).

[7]Camel and cattle are lumpy – at USD 120-250 per head average asset value – implying an order of magnitude larger absolute loss in case of catastrophic weather shocks.

[8]We rule out that the sale of goats to pay for insurance premiums explains even a majority of this effect.

capital interventions or unconditional cash transfers and grant assistance. Human capital interventions[9] 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). This may arise because human capital is a durable asset readily re-allocable across sectors in response to changing economic conditions. Studies of unconditional cash transfers and grant assistance consistently find large short-run effects, particularly on accumulation of assets, that dissipate over time, fading out in the long-run, much as our income and herd size effects do (Araujo, Bosch, and Schady, 2017; Baird, McIntosh, and Özler, 2019; Blattman, Dercon, and Franklin, 2022; Blattman, Fiala, and Martinez, 2020). We bridge these two literature by exploring the long-run impacts of an intervention to insure against catastrophic covariate shocks, demonstrating the long-run importance of risk mitigation for human capital formation.

We also build on a literature on the impacts of index insurance against aggregate weather shocks, which has so far focused on short-run impacts. Multiple studies find *ex ante* behavioral changes manifest as increases in productive investments (Karlan et al., 2014; Jensen, Barrett, and Mude, 2017; Cole and Xiong, 2017; Matsuda, Takahashi, and Ikegami, 2019; Hill et al., 2019; Belissa, Lensink, and van Asseldonk, 2020; Mishra et al., 2021; Stoeffler et al., 2022; Son, 2023). Prior studies also found that IBLI boosts income and smooths consumption *ex post* of drought shocks (Jensen, Barrett, and Mude, 2017; Janzen and Carter, 2019; Matsuda, Takahashi, and Ikegami, 2019; Noritomo and Takahashi, 2020). We contribute to this literature by demonstrating that long-run impacts also exist, but seem to arise entirely due to *ex ante* behavioral responses.

Finally, we contribute to the literature on poverty traps. Multiple studies, using several different data sets have repeatedly found evidence of multiple equilibrium poverty traps in this specific setting (Lybbert et al., 2004; Barrett et al., 2006; Santos and Barrett, 2011). Moreover, uninsured drought risk exposure seems the key driver of those poverty traps (Santos and Barrett, 2019). The theory of poverty traps arising in part due to uninsured risk exposure predicts that insurance will induce near-term behavioral changes of precisely the sort we observe, changes that yield durable, typically growing gains over time even if insurance coverage ends (Ikegami et al., 2019; Janzen, Carter, and Ikegami, 2021). We provide novel empirical evidence in support of that hypothesis.

[9]Interventions that focus on de-worming, nutritional supplementation or prenatal interventions, sometimes combined with asset transfers, skills training or other economic interventions.

# 2 Context and Index-Based Livestock Insurance

The population in the arid and semi-arid lands of northern Kenya and southern Ethiopia heavily depends on extensive livestock grazing - pastoralism - as the most productive livelihood strategy on infertile drylands (Little et al., 2008; McPeak, Little, and Doss, 2011; Jensen et al., 2024b). Households herd camels, cattle, goats, and sheep, and herd composition varies with the aridity of the location. The average herd size during our baseline is equivalent to 23 cattle.[10] On average, herds consist of 43% cattle, 33% goats or sheep and 23% camels. These animals play different roles in the productive strategies of households. Larger animals like camels and cattle are lumpy assets with values of USD 120-250 each. They are typically seen as investments, as they foster milk sales and generate valuable offspring as well as social status. As previously mentioned, goats (and sheep) are viewed as "cash with four legs." While by endline the herd composition of households in the control group remains relatively unchanged, the average herd size fell by the equivalent of nine cattle. This is broadly consistent with a growing narrative of intensifying poverty among pastoralists in the region as the frequency and severity of droughts have seemingly increased over time (McPeak and Little, 2017; Dika, Tolossa, and Eyana, 2023; Tofu et al., 2023).

The annual household-level nominal cash income of our survey households is similar at baseline and endline, roughly USD1.3-1.5 per day, implying a substantial reduction in real cash income between our baseline and endline.[11] 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 a particularly effective strategy for reducing livestock mortality and for maintaining herd lactation rates, especially for large animals (Admassu et al., 2005; Homewood et al., 2006; Sieff, 1999; Santos and Barrett, 2011).

Only 10-15 percent of household heads in our sample at baseline ever went to any school; the average completed education is approximately 10-11 months. Investments in education have, however, increased substantially over time. At baseline, the share of children aged 5-17 enrolled in school was only 48.7 percent, while it was 61.3 percent at endline. Education outcomes are closely linked to the productive strategies of these households. Children aged 5-17, especially

[10]We use cattle market value equivalents (CMVE) instead of TLU measures. We use average sales prices by species in the survey data to establish the average value by species. CMVE is strongly, positively correlated with TLU; they just aggregate across species using different weighting schemes.

[11]The endline-to-baseline cash income ratio is 531.70/498.44 = 1.07, while the endline-to-baseline CPI ratio is 2.08 in Kenya and 2.99 in Ethiopia. However, total income, including the value of in-kind livestock-and-crop-related income, is more than double cash income in these settings, as shown in Online Appendix Tables E6 and E7. 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.

boys, commonly help with herding, especially of goats and sheep. When children aren't studying full-time, a large share of them work. At baseline, 40 percent of school-aged children work full-time, while 28 percent work part-time. At endline in Ethiopia, the share of children working full-time reduced by approximately 40 percent, from 47 to 28 percent, and the share of part-time working children decreased by about 31 percent, from 26 to 18 percent. [12]

The pastoral households in our sample are vulnerable to catastrophic drought shocks. Drought-related starvation, dehydration and disease account for 47 percent of the 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 been fraying in the region, however, in part because of seemingly more frequent and severe droughts that tax all households at the same time (McPeak, Little, and Doss, 2011; Huysentruyt, Barrett, and McPeak, 2009). The aggregate nature of droughts implies that livestock markets do not allow for mitigating of shocks (Barrett et al., 2003), and – prior to IBLI – financial services were largely unavailable in these areas. As a result, herd accumulation has long been the key risk management strategy for ensuring that households can 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 another 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 (USGS) from global satellite data. IBLI uses an index that aggregates NDVI data within geographically defined index 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 drought 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.[13]

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

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

The first IBLI pilot was launched in Marsabit County, in northern Kenya, in January 2010 as a purely commercial index insurance product sold directly to individual pastoral households. This was followed by the introduction of a similar product in the neighboring Borana region of southern Ethiopia in August 2012. By 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. Households were, however, generally unaware of their status of coverage, and commercial IBLI was no longer sold in our study areas in Marsabit. In Borana, commercial sales were sustained at the same or higher volumes after the original pilot ended, but supply in our specific study locations was very low. Effectively, once the initial IBLI experiment ended in 2015, the insurance companies underwriting IBLI ceased offering it for sale in our study sites.

# 3 Study design

To study IBLI's long-run effects, 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. Household selection within those locations was random within baseline herd size strata, which is one of the most important predictors of resilience against shocks. These strata were obtained using household rosters from government administrative offices and – through community engagement – stratifying these households into three categories according to household herd size. The sample size in each site was proportional to its total population, resulting in 924 households sampled in Kenya, and 515 households in Ethiopia.

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.[14] IBLI launched with the first follow-up survey round after the baseline in each location. Panel surveys of the same households were then conducted annually for three rounds in Ethiopia and four rounds in Kenya, up to 2015. Individuals in the sample were randomly assigned to receive premium subsidies through discount coupons that were distributed just prior to a sales season. These randomized discount coupons

of contract design details.

[14]Additional details on the original research design, sample, survey tools and discount coupons can be found at 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.

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. The coupons provided households with a discount on the insurance premium for a maximum of 15 TLU. In each location in each round, 60 percent of the sample households randomly received a discount coupon providing a premium discount of 10-60 percent, at 10 percent intervals. 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. Surveys collected self-reported data on IBLI purchase. We correct for measurement error in those self-reports using the insurers' administrative records.

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 to investigate IBLI's long-run impacts ten years after the original baseline. Figure 1 shows the timeline of the original pilots, discount coupon treatments, as well as the timing of the latest rounds of survey in each country. Of the original 1,439 baseline pastoralists, 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 (Molina Millán and Macours, 2017)

## 3.1 Econometric Strategy

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 $j$.[15] $t = 0$ 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 individual $i$ in the first sales period. $X_{ij0}$ reflects a vector of household characteristics at baseline, and $D_{ij}$ is a vector of the number of sales seasons during which the household received randomized IBLI premium discount coupons.

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

To causally identify the long-run impacts of insurance, 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 anal-

[15] Location refers to 16 sublocations in Kenya and 17 kebeles in Ethiopia. Locations are nested within distinct index insurance units within which NDVI measures generate an index that determines whether an indemnity payment occurs.

Figure 1: Panel Timeline

| Year/Season | Kenya Survey | Kenya Policy | Ethiopia Survey | Ethiopia Policy |
|---|---|---|---|---|
| 2009 Oct-Nov | R1 | | | |
| 2010 Jan-Feb | | Coupon1 | | |
| 2010 Oct-Nov | R2 | | | |
| 2011 Jan-Feb | | Coupon2 | | |
| 2011 Aug-Sep | | Coupon3 | | |
| 2011 Oct-Nov | R3 | Payout1 | | |
| 2012 Mar-Apr | | Payout2 | R1 | |
| 2012 Aug-Sep | | Coupon4 | | Coupon1 |
| 2012 Oct-Nov | R4 | | | |
| 2013 Jan-Feb | | Coupon5 | | Coupon2 |
| 2013 Apr | | | R2 | |
| 2013 Aug-Sep | | Coupon6 | | Coupon3 |
| 2013 Oct-Nov | R5 | | | |
| 2014 Jan-Feb | | | | Coupon4 |
| 2014 Mar-Apr | | Payout4 | R3 | |
| 2014 Aug-Sep | | | | Coupon5 |
| 2014 Oct-Nov | | Payout5 | | |
| 2014 Nov | | | | Payout1 |
| 2015 Jan-Feb | | Contract Shift | | Coupon 6 |
| 2015 Mar | | | R4 | |
| 2015 Aug | | | | Contract Shift |
| 2015 Oct-Nov | R6 | | | |
| 2020 Aug-Sep | R7 | | | |
| 2022 Jan-Feb | | | R5 | |

*Notes*: The figure presents the timeline of the experiment in Kenya and Ethiopia. R1-R7 refers to the rounds of the panel survey. 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. Payout1-Payout5 refers to indemnity payments made to (some) recipients because the index was triggered in that season. Contract shift refers to the moment when the IBLI contract underwent changes from asset replacement to asset protection.

ysis to discount coupons and insurance purchases in the first three sales seasons, as this provides a strong instrument (see Section 5). This approach does not, therefore, identify the effect of any changes in behavior during the period with 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 equation and instrumental variable (IV) equations. We use an ANCOVA specification to estimate the LATE of IBLI purchase on long-run outcome $y$ in Equation (2), instrumenting for any insurance purchase using the number of discount coupons received by households in each of 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 ($Z$) 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 ($I_{ij4}^{t=6}$). In our specification we also include location fixed effects to control for time-invariant, location-level unobservables. Note that because households rarely migrate on their own but rather travel together with their community members from the 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). Robust standard errors are used following Abadie et al. (2022) and de Chaisemartin and Ramirez-Cuellar (2022).

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

$$I_{ij} = \alpha_0 + \alpha_1 D_{ij} + \alpha_2 y_{ij0} + \alpha_3 X_{ij0} + \alpha_4 D_{ij4}^{t=6} + \rho_j + \mu_{ij} \tag{3}$$

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

$$D_{ij} = \sum_{t=1}^{t=3} Z_{ijt}^{D} \text{ where } Z_{ijt}^{D} = 1 \text{ if } D_{ijt} > 0 \tag{5}$$

# 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).[16] We test for balance for each of our pre-specified balance variables, by whether or not a household received a discount coupon in each round in Appendix Table A1. We do not observe any significant differences per round, and normalized differences are below the threshold of 0.25 in 46 out of 48 tests. F-statistics for joint significance of all variables per round are insignificant, and so are F-statistics for joint significant of one variable across all rounds.

The right panel of Figure 2 shows that, on average, respondents purchased insurance 0.82 times. 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 full insurance coverage during the experimental period in Kenya would have been purchase of IBLI three times, while in Ethiopia the equivalent of full insurance coverage during the experimental period would have been purchase of IBLI 2.5 times. The right panel of Figure 2 shows that 29% of respondents purchased IBLI once, 14% twice, and 7.2% more than twice. The left panel of Figure 2 shows the distribution of the number of sales seasons in which pastoralists received discount coupons. On average, they received coupons 4.07 times. However, 52 percent of ever-purchased households purchased in the first sales season, 19 percent in the second sales season, and 11 percent in the third sales season. In total 83 percent of the ever-purchased households took up the insurance within the initial three sales seasons. Therefore, we would exploit less variation if we use the full six sales seasons instead of the initial three sales seasons during which most purchases occurred. Therefore, we use the three initial sales seasons of IBLI uptake and discount coupon receipts to identify the causal effects of IBLI on our pre-specified primary and secondary outcomes.[17]

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 A4. Overall, households that are not male-headed, that have fewer adults, and that do not own agricultural land were more likely to attrit from the sample (see Appendix Table A3).[18]

[16] Appendix Table C1 presents the values of our pre-specified primary and secondary outcomes at endline, ten years after the baseline.

[17] 50 households (4.2 percent of the sample) purchased IBLI 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.

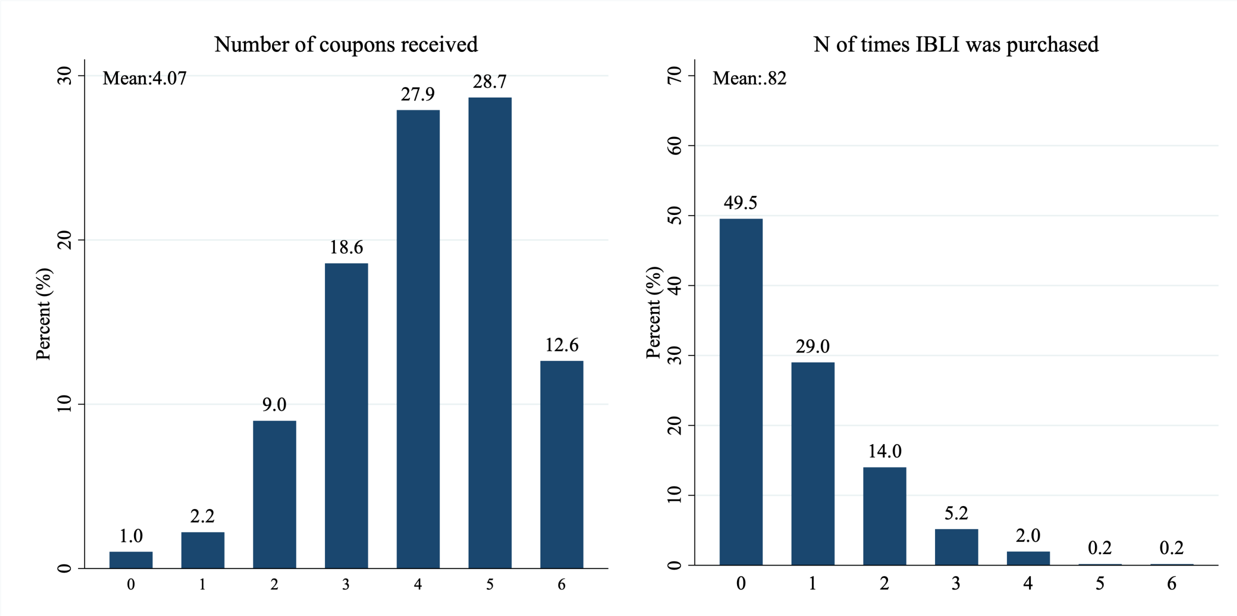
[18] We pre-specified two additional attrition tests. First, a joint test of selective attrition, which shows that only the number of adults in the household significantly predicts attrition (Appendix Table A5). Second, a test for differential

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 the household head | 48.08 | 18.00 | 98.00 | 781 | 50.23 | 20.00 | 100.00 | 398 | 48.81 | 18.00 | 100.00 | 1179 |
| | [18.35] | | | | [18.30] | | | | [18.35] | | | |
| Male headed household (=1) | 0.63 | 0.00 | 1.00 | 781 | 0.79 | 0.00 | 1.00 | 398 | 0.68 | 0.00 | 1.00 | 1179 |
| | [0.48] | | | | [0.41] | | | | [0.47] | | | |
| Household head's years of education | 1.05 | 0.00 | 16.00 | 771 | 0.54 | 0.00 | 13.00 | 397 | 0.87 | 0.00 | 16.00 | 1168 |
| | [3.07] | | | | [1.84] | | | | [2.72] | | | |
| Adult equivalent | 4.68 | 0.70 | 12.90 | 781 | 4.94 | 1.40 | 14.90 | 398 | 4.77 | 0.70 | 14.90 | 1179 |
| | [1.95] | | | | [2.01] | | | | [1.97] | | | |
| Dependency ratio | 0.50 | 0.00 | 1.00 | 781 | 0.54 | 0.00 | 1.00 | 398 | 0.51 | 0.00 | 1.00 | 1179 |
| | [0.21] | | | | [0.19] | | | | [0.20] | | | |
| Herd size (CMVE) | 25.48 | 0.00 | 416.95 | 781 | 17.01 | 0.00 | 277.38 | 398 | 22.62 | 0.00 | 416.95 | 1179 |
| | [35.98] | | | | [23.90] | | | | [32.64] | | | |
| Annual income per AE (USD) | 121.45 | 0.00 | 1617.14 | 781 | 102.79 | 0.00 | 1639.55 | 398 | 115.15 | 0.00 | 1639.55 | 1179 |
| | [198.01] | | | | [159.19] | | | | [185.95] | | | |
| Own or farm agricultural land | 0.18 | 0.00 | 1.00 | 781 | 0.65 | 0.00 | 1.00 | 398 | 0.34 | 0.00 | 1.00 | 1179 |
| | [0.38] | | | | [0.48] | | | | [0.47] | | | |
| Fully settled (=1) | 0.23 | 0.00 | 1.00 | 781 | 0.76 | 0.00 | 1.00 | 398 | 0.41 | 0.00 | 1.00 | 1179 |
| | [0.42] | | | | [0.43] | | | | [0.49] | | | |
| ***Baseline prespecified primary outcomes*** | | | | | | | | | | | | |
| Share of camels in herd (CMVE) | 0.30 | 0.00 | 1.00 | 730 | 0.12 | 0.00 | 0.98 | 395 | 0.23 | 0.00 | 1.00 | 1125 |
| | [0.31] | | | | [0.21] | | | | [0.29] | | | |
| Share of cattle in herd (CMVE) | 0.30 | 0.00 | 1.00 | 730 | 0.67 | 0.00 | 1.00 | 395 | 0.43 | 0.00 | 1.00 | 1125 |
| | [0.36] | | | | [0.25] | | | | [0.37] | | | |
| Share of goats in herd (CMVE) | 0.25 | 0.00 | 1.00 | 730 | 0.17 | 0.00 | 1.00 | 395 | 0.22 | 0.00 | 1.00 | 1125 |
| | [0.26] | | | | [0.18] | | | | [0.24] | | | |
| Share of sheep in herd (CMVE) | 0.14 | 0.00 | 1.00 | 730 | 0.05 | 0.00 | 1.00 | 395 | 0.11 | 0.00 | 1.00 | 1125 |
| | [0.17] | | | | [0.08] | | | | [0.15] | | | |
| Annual total household cash earning (USD) | 516.55 | 0.00 | 6877.83 | 781 | 462.92 | 0.00 | 5423.73 | 398 | 498.44 | 0.00 | 6877.83 | 1179 |
| | [828.25] | | | | [594.14] | | | | [757.52] | | | |
| Share of members who completed age-appropriate years of education | 0.12 | 0.00 | 1.00 | 641 | 0.11 | 0.00 | 1.00 | 333 | 0.11 | 0.00 | 1.00 | 974 |
| | [0.24] | | | | [0.22] | | | | [0.24] | | | |
| ***Baseline prespecified secondary outcomes*** | | | | | | | | | | | | |
| Herd management expenditure (USD) | 48.79 | 0.00 | 2395.60 | 781 | 41.00 | 0.00 | 2146.89 | 398 | 46.16 | 0.00 | 2395.60 | 1179 |
| | [153.93] | | | | [129.63] | | | | [146.17] | | | |
| Annual milk income (USD) | 886.04 | 0.00 | 12192.44 | 781 | 161.81 | 0.00 | 2496.61 | 398 | 641.56 | 0.00 | 12192.44 | 1179 |
| | [1668.25] | | | | [265.31] | | | | [1408.50] | | | |
| Livestock lost in the past 12 months (CMVE) | 11.05 | 0.00 | 116.90 | 781 | 9.20 | 0.16 | 200.60 | 343 | 10.49 | 0.00 | 200.60 | 1124 |
| | [15.22] | | | | [16.96] | | | | [15.79] | | | |
| N of lost camel | 1.15 | 0.00 | 61.00 | 728 | 0.28 | 0.00 | 6.00 | 343 | 0.87 | 0.00 | 61.00 | 1071 |
| | [3.56] | | | | [0.81] | | | | [3.00] | | | |
| N of lost cattle | 5.13 | 0.00 | 96.00 | 728 | 7.58 | 0.00 | 199.00 | 343 | 5.92 | 0.00 | 199.00 | 1071 |
| | [11.40] | | | | [16.04] | | | | [13.11] | | | |
| N of lost goats/sheep | 32.52 | 0.00 | 607.00 | 728 | 5.69 | 0.00 | 66.00 | 343 | 23.93 | 0.00 | 607.00 | 1071 |
| | [55.13] | | | | [8.67] | | | | [47.39] | | | |
| Distress sale in the past 12 months (CMVE) | 0.77 | 0.00 | 27.10 | 781 | 7.72 | 0.00 | 206.75 | 398 | 3.12 | 0.00 | 206.75 | 1179 |
| | [2.03] | | | | [19.66] | | | | [11.99] | | | |
| Share of children working full-time | 0.36 | 0.00 | 1.00 | 644 | 0.47 | 0.00 | 1.00 | 350 | 0.40 | 0.00 | 1.00 | 994 |
| | [0.38] | | | | [0.34] | | | | [0.37] | | | |
| Share of children working part-time | 0.29 | 0.00 | 1.00 | 644 | 0.26 | 0.00 | 1.00 | 350 | 0.28 | 0.00 | 1.00 | 994 |
| | [0.39] | | | | [0.32] | | | | [0.37] | | | |
| Share of children studying full-time | 0.22 | 0.00 | 1.00 | 644 | 0.12 | 0.00 | 1.00 | 350 | 0.18 | 0.00 | 1.00 | 994 |
| | [0.36] | | | | [0.23] | | | | [0.32] | | | |
| Observations | 781 | | | | 398 | | | | 1179 | | | |

Notes: All columns present mean, standard deviation (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=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.

Figure 2: Number of coupons received and the seasons with ANY IBLI purchase




Notes: The left panel x-axis presents the number of coupons that respondents received during the six sales seasons in the experiment. 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 x-axis presents the number of seasons that respondents purchased insurance. The y-axis shows the percent of respondents who purchased insurance 0, 1, 2, 3, 4, 5, or 6 times during these six sales seasons.

# 5 Results

We first examine the effect of randomized discount coupons on insurance purchase, the first stage of our causal identification strategy. Figure 3 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. We indeed observe a strong, positive correlation ($p$-value<0.001). Table 2 presents the first stage estimation results of Equation (3). Columns 2-7 present the estimated effect of receiving a discount coupon on insurance purchase in each round. In the first three rounds, coupon receipt significantly predicts insurance purchase, at the one percent significance level in the first season, and at the five percent level in the second and third seasons. There is no significant effect of the discount coupon on insurance purchase in any of the latter three seasons. We therefore choose the number of coupons that a respondent received during the first three seasons as our instrument.

Column 1 of Table 2 presents the results of Equation (3), where we estimate the effect of the

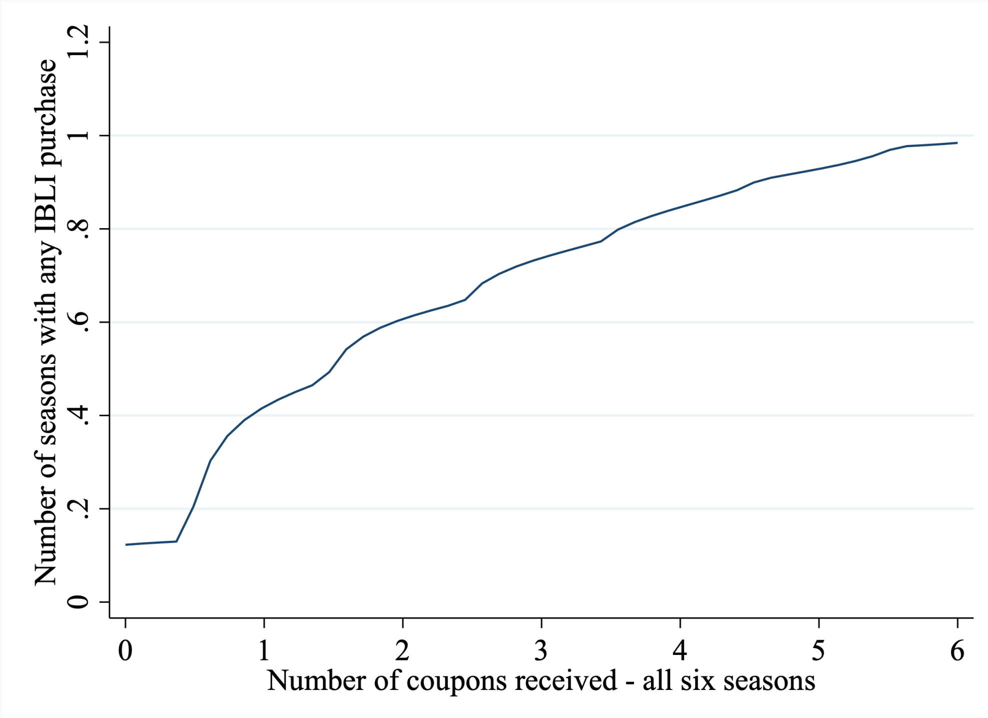
attrition per survey round shows that respondents that received a discount coupon are 5 percentage points less likely to attrit in sales season 3 (Appendix Table A6).

Table 2: First stage regression results

| | Any insurance purchased – first three seasons | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| No. of coupons received – first three seasons | 0.123*** | | | | | | |
| | (0.016) | | | | | | |
| Received coupon – first season | | 0.167*** | | | | | |
| | | (0.029) | | | | | |
| Received coupon – second season | | | 0.069** | | | | |
| | | | (0.030) | | | | |
| Received coupon – third season | | | | 0.064** | | | |
| | | | | (0.030) | | | |
| Received coupon – fourth season | | | | | 0.004 | | |
| | | | | | (0.030) | | |
| Received coupon – fifth season | | | | | | -0.014 | |
| | | | | | | (0.031) | |
| Received coupon – sixth season | | | | | | | -0.049 |
| | | | | | | | (0.035) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Effective F-stat | 56.522 | 32.837 | 5.294 | 4.639 | 0.020 | 0.213 | 1.937 |
| 10% Critical Value | 23.109 | 23.109 | 23.109 | 23.109 | 23.109 | 23.109 | 23.109 |
| N | 1179 | 1166 | 1154 | 1165 | 1154 | 1151 | 1151 |

Notes: The table presents the first stage regression, the estimated effect of the number of discount coupons received in the first three seasons on any insurance purchase in the first three seasons. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Row "10% Critical Value" reports 10 percent critical values from Olea and Pflueger (2013). We compare these cutoffs to effective F-statistics to test for weak instruments. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Figure 3: Correlation - IBLI purchase and coupon receipt




Notes: The x-axis presents the number of seasons in which the respondent received discount coupons during the six sales seasons. The y-axis shows the likelihood that a respondent purchased any insurance during these seasons. The black line represents the relationship between the number of coupons received and the number of seasons with any IBLI purchase.

number of coupons received in the first three seasons on whether or not a respondent purchased any insurance during the first three seasons.[19,20] An increase in one additional coupon received in these first three seasons, significantly increases the likelihood that a respondent purchased insurance by 12.3 percentage points, which is significant at the one percent level. The effective F-statistics of Olea and Pflueger (2013) are greater than the critical value at the 10 percent level, providing support for the strength of our instrument.

[19]In the pre-analysis plan we pre-specified the endogenous variable as the cumulative insurance purchase {0,1,2,3} in the first three seasons. However, this specification violates the monotonicity assumption that is required for valid instruments, because the number of times insurance is purchased does not increase monotonically with the number of discount coupons received (Appendix Table C2). When instead, we create a binary variable of whether or not the respondent purchased any insurance in the first three seasons, insurance purchase does monotonically increase with the number of discount coupons received, and we therefore use this endogenous variable.

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

## 5.1 Primary outcomes

We report the coefficient estimates for our pre-specified primary outcomes – following Equation (2) – in Tables 3 and 4.[21] We do not observe any significant effect of insurance purchase on either herd size[22]or household cash earnings.Appendix Tables C3 and C4 show the effects of IBLI uptake on the intensive and extensive margin of cash and in-kind income. These results show large but noisy point estimates for most total (cash plus in-kind) income measures. We observe a strong, positive impact on education – a 16.8 percentage points increase in the likelihood that a household member has completed the age-appropriate years of education, significant at the five percent level, relative to a control mean of 11.5, representing a 146% increase.[23]

For robustness we also consider other indicators of educational attainment that were not pre-specified. Appendix Table C6 presents effects on maximum, total, and average years of education. We observe an increase of 2 years in the maximum years of education, which is noisily estimated with a *p*-value of 0.145. With respect to the total years of education, we observe a 4.8 years increase in the total household-level years of education, relative to 8.5 years in the control group, a 56 percent increase with a *p*-value of 0.109. In terms of the average years of education, we observe an increase of 2.3 years, from a control mean of 4.9 years, a 47 percent increase, significant at the five percent level. Appendix Table C8 reports additional estimations analyzing effects on different education levels – any schooling, four years of primary school, completed primary, or completed secondary. The results show that the share of household members that completed any schooling increased by 20.8 percentage points, from a control mean of 64.6 percent, significant at the ten percent level. We also observe an increase of 16.2 percentage points in the share of household members who completed at least 4 years of primary education (*p*-value 0.198); and a 14.2 percentage points increase in the share of household members who completed primary (*p*-

[21]Missing values in control variables are replaced with the mean value of the variable within each country.

[22]To express herd size, we use the Cattle Market Value Equivalent (CMVE), which aggregates the value of all animals in a herd across species, weighted by average market value of each animal type, expressed in terms of the mean market value of cattle. To construct this measure for each country, we use the average market prices from purchases and sales for each animal type reported by pastoral households in all rounds of our panel data between 2010 and 2022. For Kenya, 1 cattle is equivalent to 0.625 camels, 10 goats or 10 sheep. For Ethiopia, 1 cattle is equivalent to 0.4 camels, 10 goats, and 10 sheep. The average market values from our sales and purchases data are presented in Online Appendix Table E1. CMVE accomplishes the same cross-species aggregation purpose as the more familiar Tropical Livestock Unit (TLU) measure, which weights species according to the physical weight of the average adult animal, which proxies for its nutrient intake needs. Because our interest is in total herd size or herd size composition as a productive asset or as a store of wealth, we favor aggregation based on market value rather than biophysical requirements. The two are necessarily very strongly, positively correlated. We check for robustness to using CMVE or TLU in Online Appendix Tables D1.

[23]The sample size for the share of children who completed age-appropriate years of education decreases to 770, because the outcome variable is treated as missing when there were no school-aged household members during the pilot period. The results are qualitatively the same when we impute the average share of age-appropriate household members by each country to missing values of the outcome variables.

Table 3: Prespecified primary outcomes: Herd size, earnings, education

| | Herd size (CMVE) | | Annual household cash earnings (USD) | | Share of members who completed age-appropriate years of education | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Any insurance purchased | 2.078 | 3.308 | -6.640 | 5.497 | 0.173** | 0.168** |
| | (8.731) | (8.856) | (208.960) | (209.810) | (0.088) | (0.084) |
| Controls | | ✓ | | ✓ | | ✓ |
| Control mean | 14.265 | 14.265 | 529.673 | 529.673 | 0.115 | 0.115 |
| Observations | 1179 | 1179 | 1179 | 1179 | 762 | 762 |

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 herds expressed in CMVE, "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 "share of members who are age-appropriate education" is the share of household members who are in age-appropriate education for the cohorts who were school-aged during experiments. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 762 of the 1179 households for column (5) and (6) excluding households that do not have relevant cohort members within the households. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep. Please refer to Table 1 for the definition of outcome variables.

Table 4: 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 | 0.123 | 0.120 | 0.108 | 0.107 | -0.225** | -0.235** | -0.007 | 0.009 |
| | (0.091) | (0.092) | (0.083) | (0.083) | (0.096) | (0.097) | (0.052) | (0.052) |
| Controls | | ✓ | | ✓ | | ✓ | | ✓ |
| Control mean | 0.263 | 0.263 | 0.332 | 0.332 | 0.284 | 0.284 | 0.121 | 0.121 |
| 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 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 blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 987 of the 1179 households excluding households that are not currently herding any livestock. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

value 0.198). We do not observe an effect on completion of secondary education.

We also examine if the increase in educational attainment was driven by male or female household members. If indeed the shift in production strategies - in particular, away from herding small animals – drove the education results, we would expect effects to predominantly arise for male household members, given that boys most commonly herd goats and sheep. Appendix Table C9 presents the results for male households members in Panel A and female household members in Panel B. The effects are indeed driven by boys.[24]

In addition to our results on education, we also observe a substantial change in production strategies through a shift in herd composition. Table 4 shows a substantial decrease of 23.5 percentage points in the share of goats herded, significant at the five percent level, relative to a control mean share of 28.4, which implies an 83 percent decrease. There are no changes in the share of sheep herded, so by construction we see increases in the share of camels and cattle herded. Point estimates for camels and cattle are positive and marginally insignificant ($p$-value=0.190 and

[24]To determine whether the educational effect is influenced by changes in household composition, Appendix Table C10 presents the effects on fertility and the correlation between more educated households at baseline and the share of young adults at endline. Columns (1) and (2) demonstrate that there is no effect of insurance on fertility decisions. Columns (3) and (4) reveal a positive correlation between higher-educated households at baseline and the share of young adults at endline. Taken together, these findings suggest that the effect is not driven by changes in the composition of household members with varying educational backgrounds.

0.198, respectively), suggesting a transition to both types of animals, likely as most appropriate to location-specific rangeland conditions. To increase statistical power, we also analyze effects by comparing large ruminants (camel and cattle combined) to small ruminants (goats and sheep) in Appendix Table C11. The sign of the coefficient estimates on the share and the number of animals are similar. The share of larger animals increases by 23 percentage points, significant at the five percent level, while the share of smaller animals decreases for respondents who purchased insurance.

### 5.2 Secondary outcomes

The results for our pre-specified secondary outcomes are reported in Tables 5 and 6, following Equation (2), with and without controls. We observe no statistically significant effects of IBLI purchase on any of our secondary outcomes, except for children's activities. The standard errors are large for all outcomes, except for annual total milk income, where the point estimate is positive and as large as the mean in the control group.

With respect to children's time use we observe a similar pattern of large, noisy point estimates. Children's full-time and part-time work fall by an estimated 32.2 and 26.1 percentage points, respectively, relative to a control mean of 27.1 and 20.1, respectively ($p$-value 0.251 and 0.304), suggesting that insurance minimizes the likelihood that children work either full- or part-time. Consistent with results on education, we also observe an increase in children studying full-time, an estimated increase of 46.7 percentage points, double the control mean of 23 percent ($p$-value 0.093). Induced changes in children's time use are consistent with the observed improvements in educational attainment induced by catastrophic drought insurance coverage.

## 6 Interpersonal spillovers

In this section, we consider the potential effect of interpersonal spillovers on our estimates. We are particularly concerned about intra-community spillovers biasing our LATE estimates because randomization was done at the individual-level, within communities, implying that the take-up or outcomes measured in control households could be influenced by the discount coupons, take-up or outcomes of treated households. Given prior evidence that individuals informally share risk with each other and that IBLI uptake affects informal risk sharing (Takahashi, Barrett, and Ikegami, 2019), spillovers in IBLI take-up or in the outcomes of insurance are plausible.

The original experiment randomized households within communities, each season, to either

Table 5: 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 | 2.611 | 2.634 | 311.749 | 377.169 | 1.813 | 1.840 | -0.331 | -0.389 | -1.144 | -1.078 |
| | (89.456) | (89.841) | (392.579) | (401.425) | (2.893) | (2.802) | (0.529) | (0.532) | (1.457) | (1.449) |
| Controls | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| Control mean | 167.891 | 167.891 | 359.879 | 359.879 | 5.448 | 5.448 | 0.292 | 0.292 | 1.872 | 1.872 |
| Observations | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 781 | 781 | 1179 | 1179 |

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 expenditure for herd management such as fodder expressed 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, and "livestock sale" is measured as sales for livestock expressed in CMVE. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 781 of the 1179 households for column (7) and (8) excluding households who are missing. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table 6: 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 full-time | | Working part-time | | Studying full-time | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Any insurance purchased | 0.033 | 0.036 | -0.974 | -0.949 | -0.296 | -0.322 | -0.213 | -0.261 | 0.437* | 0.467* |
| | (0.043) | (0.044) | (0.896) | (0.940) | (0.270) | (0.280) | (0.240) | (0.254) | (0.265) | (0.278) |
| Controls | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| Control mean | 0.042 | 0.042 | 0.539 | 0.539 | 0.271 | 0.271 | 0.201 | 0.201 | 0.232 | 0.232 |
| Observations | 1179 | 1179 | 1179 | 1179 | 376 | 376 | 376 | 376 | 376 | 376 |

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 by the uptake in the last 12 months before the endline survey evaluated by the dummy and CMVE, respectively, and children's time use as the share of children aged 5-17 who study full-time, work part-time, and study full-time, respectively. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Columns (5) to (10) report the estimated coefficients with 376 observations, which is also due to the absence of this information in Kenyan sample at the endline. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

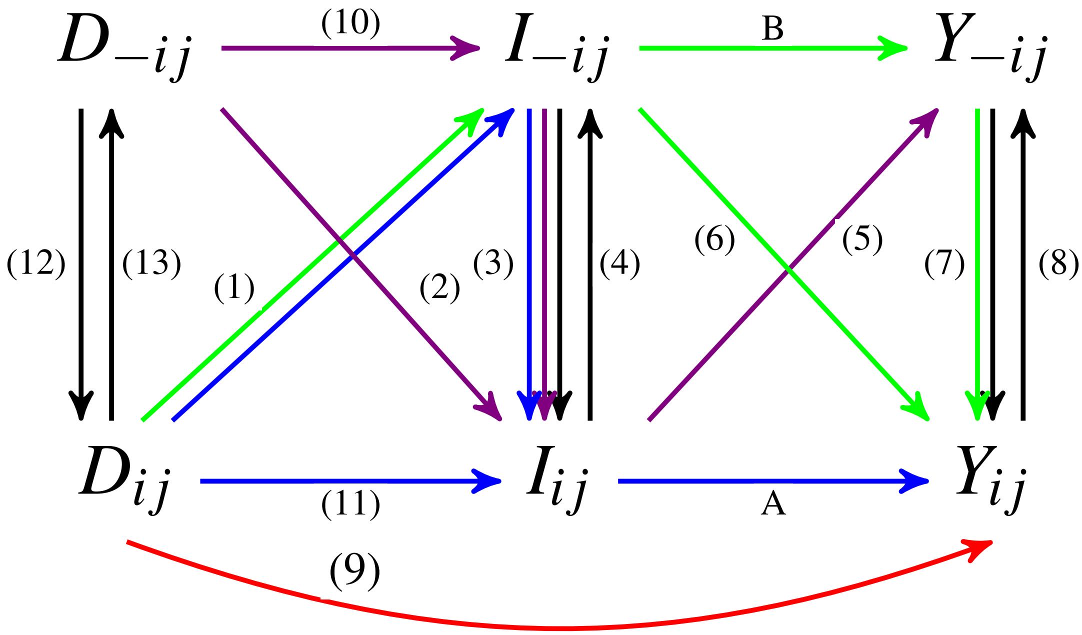
receive discount coupons or not. At the level of individuals in one community this thus creates random variation in the intensity of encouragement received by peers. If we pool individuals in the sample across communities, we then have across-community variation in the intensity of the instrument of both the recipient and their peers, which we leverage to investigate spillovers. We do so in the first stage – so from peers' discount coupons receipt 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 within a community, if one respondent received a coupon, his peers were (slightly) less likely to receive one. This implies that we can check if our main results are robust to potential spillovers, but we can not quantify or 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 that may exist in our first- or second stages. These are graphically represented by Figure 4. 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 there are no inter-community spillovers.

The blue line A represents the main causal effect we are interested in estimating, namely the effect of $i$'s insurance 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 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 $i$. We do so by taking the mean of the number of coupons received and the mean of insurance purchase by all peers in the community. Following the same logic we also create a vector of control covariates for all peers in the community. Table B2 shows the results of the first-stage estimates. Column (1) and (2) show that there is indeed the expected negative correlation between discount coupons received by the recipient and their peers, although

Figure 4: 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 $j$, $I_{ij}$ is their insurance purchase, and $Y_{ij}$ their long-run outcome. Other herders from community $j$, termed "peers," are denoted as $-i$. We refer to their discount coupons received, insurance purchase, and long-run outcomes as $D_{-ij}$, $I_{-ij}$, and $Y_{-ij}$, respectively. Our main causal effect of interest is A, where we estimate the LATE of $I_{ij}$ on $Y_{ij}$, instrumenting $I_{ij}$ by $D_{ij}$. The blue arrows present this main specification. The red pathway presents a direct violation of the exclusion restriction. The green pathways present indirect violations of the exclusion restriction and violations of SUTVA, the purple pathways present violations of SUTVA. The black arrows indicate mechanical negative correlations. See Appendix B for more details.

imprecisely estimated. Columns (3)-(5) show that the effect of the number of discount coupons received by the recipient on their insurance purchase is unaffected in size and significance by inclusion of the peers' discount coupons' receipt. Columns (6)-(8) 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.

Finally, we test for the robustness of our main results by including the mean number of discount coupons received by peers as additional instrument, and mean insurance purchase by peers as additional endogenous regressor in our main specifications in eq. (2) and (3). Tables B3 to B6 present the second-stage results. Given that we leverage across-community variation in the intensity of encouragement of recipients and peers, we do not include community fixed effects. The results are qualitatively similar to the main results, except for the positive effect on whether or not children study full-time, which disappears and becomes insignificant. In some specifications, we lose statistical power on the education results due to the addition of another instrument and endogenous regressor, as coefficient estimates on $\hat{\hat{I}}_{-ig}$ indicate that there is no effect on $i$'s education outcomes. Overall, these checks for robustness to prospective SUTVA violations due to interpersonal spillovers reinforce our central findings.

# 7 Mechanisms

Several potential mechanisms may explain the long-run effects of IBLI. Note that we can exclude the possibility that take-up during the experimental period induced continued IBLI uptake in later periods, thus that being insured continuously drives the observed long-run effects. Supply constraints in our study villages largely precluded IBLI purchaseafter the research team stopped providing last mile sales support following the end of the experiment. So the observed effects arise from transitory insurance exposure, as one might expect in a context previously shown to exhibit multiple equilibrium poverty traps (Lybbert et al., 2004; Barrett et al., 2006; Santos and Barrett, 2011; Santos and Barrett, 2019).

## 7.1 Impact dynamics over time

To investigate effects dynamics, we estimate Equation (2) on the same outcomes reported in the survey after the third sales season ($\sim$1.5 years after the IBLI introduction), as well as at the end of the experiment, after the sixth sales season ($\sim$3 years after the IBLI introduction). The effect on herd composition materialized by the end of the experiment, simultaneously with the effect on educational attainment (Figures 5 and 6),[25] and the estimated effects grow in magnitude after the experiment ended. No significant effects emerged at any time horizon for herd size or cash income.[26] Children's time use effects are imprecisely estimated for outcomes after the third sales season and the end of the experiment(Appendix Table C18), implying that those effects arise only by the time of the long-run follow-up.

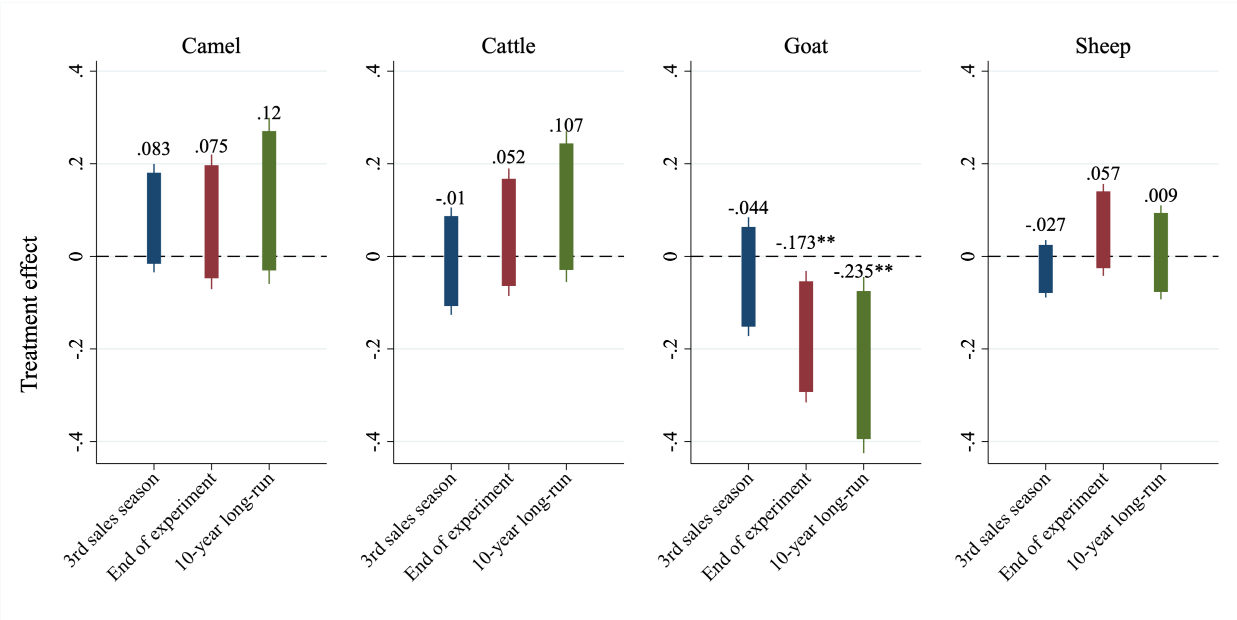
Figure 5 shows that significant effects on herd composition for the share of goats start to arise by the end of the experiment.[27] We see a negative and significant 17.3 percentage points reduction in the share of goats by the end of the experiment, relative to a 23 percent control mean, significant

[25]These effects are confirmed in the other measures of educational attainment (Appendix Table C13)

[26]Regression results underlying these figures are in Appendix Tables C11-C18.

[27]See Appendix Table C14 for regression results.

Figure 5: Dynamic effects on herd composition



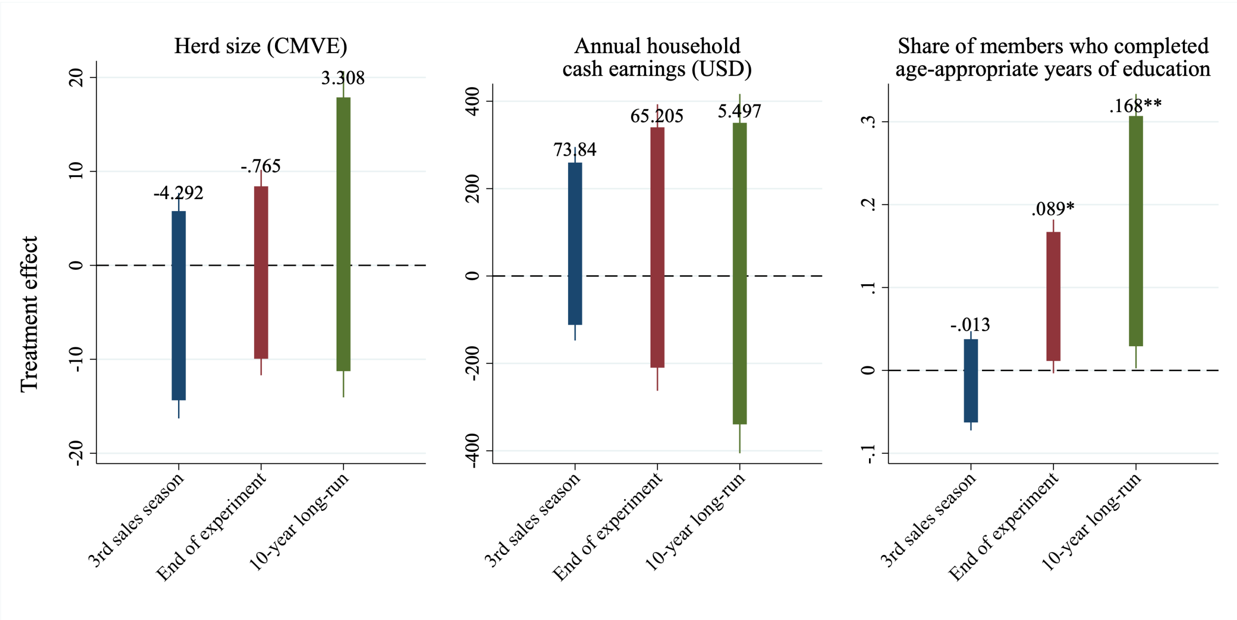

Notes: This figure presents the estimated LATE of IBLI purchase in the first three seasons – instrumented by the number of discount coupons received by recipients in the first three seasons – on outcomes i) after the third sales season, ii) after the end of the experiment (sixth sales season), and iii) at the 10-year follow up. 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.

at the five percent level. For camels we already observe a marginally insignificant 8.3 percentage points ($p$-value 0.161) increase in the share of camels by the end of the third sales season, which largely persists until the long-run follow-up. For cattle there are also positive point estimates from the end of the experiment onward, but these are less precisely estimated.

The herd composition and educational attainment effects are substantively linked, not just co-incident in time. Larger species like camels and cattle generate greater income - e.g., milk, calves - per TLU, yielding a positive income effect on educational investment. This herd composition change also reduces household demand for child labor because children's marginal productivity of herding camels or cattle is much lower than that of herding goats, an effect that is especially pronounced for boys, as expected.

These outcomes are consistent with multiple prospective mechanisms. The formal financial insurance product may have reduced the need for precautionary savings in-kind, in the form of highly liquid goats, to cover drought-related expenditures on food (to replace lost milk production), fodder, water, and veterinary expenses. IBLI indemnity payments provide an alternative to cover such costs. So IBLI purchasers could reasonably expect to substitute insurance for savings to

Figure 6: Dynamic effects on income, asset, and human capital




Notes: This figure presents the estimated LATE of IBLI purchase in the first three seasons – instrumented by the number of discount coupons received by recipients in the first three seasons – on outcomes i) after the third sales season, ii) after the end of the experiment (sixth sales season), and iii) at the 10-year follow up. 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.

cope with such contingencies. A second candidate mechanism consistent with these results is that households induced to purchase IBLI had to liquidate goats to buy insurance. We often heard herders say they "sold a goat to insure a cow". A second, complementary explanation to those first two is that households invest more in camels (Appendix Table C23), a higher-return, more drought-resistant asset than goats, but much lumpier investments. By reducing households' need for liquidity during or following a drought, IBLI may have induced households to re-balance their livestock portfolio towards lumpier, more productive but less liquid species.[28]

These induced herd composition changes reinforced household investment in children's education, because while children routinely manage goats, camels are large, strong and ornery, managed overwhelmingly by adult men. Our results suggest that the observed changes in herd composition preceded or coincided with changes in education, suggesting that induced changes in production strategies may have helped drive changes in the marginal productivity of child labor, thereby boost-

[28]Some portion of the herd composition shift could also have been the result of households selling goats to purchase IBLI 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.

ing investments in education, similar to Shah and Steinberg (2017). The large (albeit imprecisely estimated) total income gains from being insured would have only reinforced these child labor effects to induce the sharp observed increase in educational attainment.

## 7.2 Indemnity payments as lump sum transfers

Consistent with the proposed mechanisms above, we investigate whether the long-run outcomes are driven by *ex ante* behavioral effects induced by reduced catastrophic risk exposure resulting from purchasing insurance, or from *ex post* impacts of IBLI 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 relieved savings or liquidity constraints, incentivizing 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).

To investigate these potential channels, we modify our prior regression specification to include the receipt of indemnity payments, which are conditional on both (instrumented) insurance purchase and exogenous drought shocks. Therefore we estimate the following second-stage equation:

$$y_{ijT} = \gamma_0 + \gamma_1 \widehat{I_{ij}} + \gamma_2 \widehat{I_{ij}} \times R_{jt} + \gamma_3 y_{ij0} + \gamma_4 X_{ij0} + \gamma_5 D_{ij4}^{t=6} + \rho_j + \varepsilon_{ijT} \quad (6)$$

where $R_{jt}$ is an exogenous indemnity payment rate specific to the index unit for the three periods of insurance uptake for which we instrument, as determined by the NDVI realization and the prespecified IBLI contract terms. The receipt of an indemnity payment is the combined effect of being insured and experiencing a weather shock. The latter is exogenous, and absorbed through the location fixed effect, so the coefficient ($\gamma_2$) on $\widehat{I_{ij}} \times R_j$ is the direct effect of the indemnity payment on outcomes ($\gamma_2$).

Note that during the initial three sales seasons, payouts were only observed once in Kenya, and not at all in Ethiopia. The coefficient $\gamma_1$ captures the effect of 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 receiving the indemnity payment are captured by $\gamma_1 + \gamma_2$, which is the marginal effect of interest in the event an indemnity payout occurs.

Appendix Tables C19 to C22 show the results of estimating Equation (6) for the primary and secondary outcomes. The marginal effect of receiving insurance and an indemnity payment

($\gamma_1 + \gamma_2$) appears in the first row of the bottom panel of the tables, its $p$-value in the second row. Appendix Table C19 shows that there are no meaningful nor significant effects for herd size or cash earnings. For education, we see that the coefficient on insurance purchase remains strong and positive, irrespective of the indemnity payment. The indemnity payment did not have statistically significant effect on education either. The combined effect of insurance and indemnity payment, however, is positive, a 18 percentage points increase, and statistically significant, with a $p$-value of 0.039. Appendix Tables C20, C21 and C22 also show that none of the direct effects of indemnity payments on either pre-specified primary or secondary outcomes are statistically significant.

These results suggest that a cash liquidity injection from indemnity payments explains our 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, we demonstrate 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 consistent with prior findings of subjective well-being gains from IBLI coverage even in the absence of payouts (Tafere, Barrett, and Lentz, 2019), as well as *ex ante* effects of insurance that are found, 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).

# 8 Conclusions

A sizable literature has established that catastrophic covariate shocks can have adverse effects on long-run human capital accumulation. It would seem to follow, therefore, that insurance against such shocks can boost human capital accumulation, but direct evidence on this important question has been lacking to date. We exploit the randomized encouragement design of the original impact evaluation of index-based livestock insurance (IBLI), a catastrophic drought insurance product introduced among pastoralist populations in northern Kenya and southern Ethiopia in 2010-12, and followed up with the original survey households ten years later to test that hypothesis.

We find that insurance coverage sharply changed household's production strategies and increased children's educational attainment. Insured households decreased the small ruminant - goats and sheep - share of their herd by 83 percent in favor of largestock (mainly camels), while the share of household members who completed age-appropriate education rises 146%, to 28 percent. The share of children studying full-time increased sharply in insured households and that change is much more pronounced among boys than girls, consistent with reduced household demand for (mainly boys') labor herding goats. Importantly, these effects are driven entirely by the insurance coverage itself rather than by receipt of cash indemnity payments triggered by drought events. This implies that the reduced *ex ante* risk exposure through insurance coverage and the behavioral changes that induces generate the observed long-term effects, not financial liquidity enhancements through lump-sum cash transfers due to indemnity payments. Insurance does not, however, increase herd sizes nor cash income, and has only a statistically insignificant, but large, positive impact on total household income at decadal scale.

Our research illuminates both the important role of formal risk mitigation instruments can play for human capital accumulation and the need for complementary interventions, rather than depending on single policy instruments to achieve all development objectives. 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 1.6 million pastoralists across the Horn of Africa. While this can help protect human capital from drought shocks and thereby promote children's education, complementary interventions will likely be 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 specification in which we test the balance of the randomized 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)[29]:

$$k_{ijt} = \gamma_1 + \gamma_2 \mathrm{D}_{ijt} + \rho_j + \nu_{ijt} \tag{7}$$

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 a location fixed effects, and $\nu_{ijt}$ is an error term.

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, 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.

## A.2 Attrition

This subsection presents specification in which we test the attrition, and additional 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. Because our main instrument uses the number

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

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

$$\text{Attrition}_{ijT} = \delta_0 + \delta_1 \text{D}_{ij} + \gamma_j + \omega_{ij} \tag{9}$$

where $Attrition_{ijT}$ is an indicator of attrition 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 $\omega_{ij}$ error term. Column (1) of Table A4 reports the regression 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 cumulative coupons receipt in all six sales seasons, and Column (2) of Table A4 shows our results are similar.

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:

$$\text{Attrition}_{ijT} = \kappa_0 + \kappa_1 \text{D}_{ijt} + \kappa_2 \text{Discount Rate}_{ijt} + \kappa_3 \text{Absent}_{ijt} + \rho_j + \omega_{ijt} \tag{10}$$

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 coupon. 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 status other than the pooled analysis in 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 90 percent level. We do not find the discount rates have any effect on attrition.

Finally, we consider selective attrition by our pre-specified observable household characteristics. To do this, we regress each household characteristics on the attrition indicator – i.e., weestimate the following equation:

$$X_{ij0} = \zeta_0 + \zeta_1 Attrition_{ijT} + \rho_j^1 + \sigma_{ijt}^1 \tag{11}$$

where $X_{ij0}$ is the vector of characteristics of household $i$ in community $j$ at baseline. In addition to each coefficients, we also conduct joint significance test to verify if a series of characteristics of attrited group is jointly statistically different from that of the retained group. As reported in the main text, Table A3 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 the selective attrition by regressing the attrition indicator on the vector of baseline household characteristics. We estimate the following equation:

$$Attrition_{ijT} = \theta_0 + \theta_1 X_{ij0} + \rho_j^2 + \sigma_{ijt}^2 \tag{12}$$

where all variables are defined the same as Equation 11. Reported results in Table A5 shows that an additional adult household member makes a household significantly less likely to attrit by 1 percentage point, and this estimate is significant at the 10 percent level. None of the other pre-specified observables significantly predict attrition.[30]

[30] 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 of coupon distribution

| | 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] | |
| Education of household head | -0.238 | -0.0563 | -0.0407 | 0.0914 | -0.224 | 0.183 | 5.99 |
| | (0.171) | (0.170) | (0.163) | (0.155) | (0.158) | (0.157) | {0.424} |
| | [-0.121] | [-0.0606] | [-0.0805] | [-0.0370] | [-0.153] | [0.0777] | |
| Adult equivalent | -0.00907 | 0.0569 | -0.108 | -0.0176 | -0.137 | -0.142 | 3.43 |
| | (0.120) | (0.118) | (0.119) | (0.116) | (0.119) | (0.147) | {0.753} |
| | [0.0308] | [0.0414] | [-0.00252] | [0.0267] | [-0.0253] | [-0.0707] | |
| Dependency ratio | -0.00238 | -0.00368 | 0.00527 | 0.0125 | 0.0148 | -0.0123 | 4.59 |
| | (0.0118) | (0.0114) | (0.0113) | (0.0110) | (0.0109) | (0.0123) | {0.597} |
| | [0.0446] | [0.0462] | [0.0940] | [0.129] | [0.138] | [-0.0634] | |
| Herd size (CMVE) | 1.14 | -0.917 | -0.252 | -1.36 | 0.453 | -2.06 | 3.17 |
| | (1.63) | (1.61) | (1.69) | (1.44) | (1.15) | (1.87) | {0.787} |
| | [-0.0200] | [-0.0637] | [-0.0410] | [-0.0261] | [0.0794] | [-0.0876] | |
| Annual income per AE (USD) | -4.77 | -15.8 | -3.28 | 11.1 | -2.64 | -20.0 | 4.03 |
| | (10.2) | (15.5) | (13.7) | (10.6) | (12.8) | (16.4) | {0.673} |
| | [-0.0438] | [-0.113] | [-0.0875] | [0.0173] | [-0.0829] | [-0.0816] | |
| Own or farm agricultural land | -0.0293* | -0.00378 | 0.0151 | 0.0221 | -0.0169 | -0.00445 | 6.95 |
| | (0.0174) | (0.0170) | (0.0157) | (0.0166) | (0.0159) | (0.0190) | {0.326} |
| | [0.152] | [0.204] | [0.290] | [0.259] | [0.180] | [-0.00469] | |
| F statistics of Joint F-test: | 5.988 | 4.702 | 4.279 | 8.845 | 8.241 | 8.770 | |
| P-value of Joint F-test: | 0.649 | 0.789 | 0.831 | 0.356 | 0.410 | 0.362 | |

Notes: The table presents effects of receiving coupon on different household characteristics as outcomes presented in each row. 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 difference (in square brackets) between the coupon recipients and non-recipients. All estimations include country and community fixed effects. Column (7) reports joint significance test for each variable across seasons where the first row presents the Chi-statistics and the second row presents the p-value of the test statistic in brackets. Dependency ratio is the ratio of dependents – people younger than 15 or older than 64 – to the working-age population, those ages 15-64. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table A2: N of households present in each round

| | Kenya | | | Ethiopia | | |
|---|---|---|---|---|---|---|
| | Total | Original sample | *Net* replacement | Total | Original sample | *Net* replacement |
| | (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: This table shows the number of households interviewed in each round. Column (1) and (4) show the number of households surveyed for each round. Column (2) and (5) are defined on the balanced sample in *and*. Column (3) and (6) show the number of households for the replacement. *Balanced sample* and *Initial & Last* show the number of households surveyed in all periods, and $R1$ and $R7$, respectively. Balanced sample gives balanced panel across all the rounds. *Net* replacement at round $t$ is calculated by total minus samples from previous years.

Table A3: Attrition across baseline characteristics

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

Notes: The table presents the estimated results of testing selective attrition among our sample, using different household characteristics as outcomes in each row. Each outcome is a characteristic of a household $i$ in area $j$ at baseline. 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 country and community fixed effects. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. p-value from the joint significance test for all variables across attrition is reported at second from the bottom row.

Table A4: Differential attrition across cumulative coupon receipt status

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

Notes: The table presents the estimated results of testing differential attrition across the total number of coupons received by each household over the initial three sales seasons and all six sales seasons. The outcome is whether a household $i$ in area $j$ was interviewed at baseline, but not in the latest round. Estimated coefficients and robust standard errors (in parentheses) are reported in each column. All estimations include country and community fixed effects. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table A5: Joint test of selective attrition

| | Outcome: Interviewed at baseline but not in latest 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 the correlation of attrition among our sample with different household characteristics estimated jointly. The outcome whether a household $i$ in area $j$ was interviewed at baseline, but not in the latest round. Estimated coefficients and robust standard errors (in parentheses) are reported. All estimations include country and community fixed effects. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. p-value from 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 latest 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 estimated results of testing differential attrition across the coupon receipts and discount rates, in percentage terms, from the coupons received by each household in each of the six sales seasons. The outcome is whether a household $i$ in area $j$ was interviewed at baseline, but not in the latest round. Estimated coefficients and robust standard errors (in parentheses) are reported. All estimations include country and community fixed effects. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

# B Spillover

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 Value 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. However, if we relax SUTVA, this can lead to spillovers in the second stage, from a herder's insurance purchase decision onto her peers' insurance purchase decision; from a herder's purchase decision onto her peers' outcomes; or from a herder's outcomes onto her peers' outcomes. Furthermore, spillovers may also arise in the first stage, where a herder's receipt of a discount coupon affects her 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 4 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 4 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 ($D_{-ij}$): This is constructed by creating a variable for each herder $i$ that is the mean of the number of coupons received in the first three seasons by all other herders ($-i$) in their community $j$:

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

  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 ($I_{-ij}$): This is constructed by creating a variable for each herder $i$ that is the share of herders $-i$ out of all herders in the community except for $i$ that purchased any insurance during the first three seasons:

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

  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 B1. 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: Summary statistics of the spillover variables

| | Kenya | | | | Ethiopia | | | | Pooled | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs | Mean/SD | Min | Max | Obs |
| $D_{ig}$: No. of coupons received – first three seasons | 1.78 | 0.00 | 3.00 | 781 | 1.57 | 0.00 | 2.00 | 398 | 1.71 | 0.00 | 3.00 | 1179 |
| | [0.87] | | | | [0.60] | | | | [0.79] | | | |
| $I_{ig}$: Any insurance purchase - first three seasons | 0.41 | 0.00 | 1.00 | 781 | 0.45 | 0.00 | 1.00 | 398 | 0.42 | 0.00 | 1.00 | 1179 |
| | [0.49] | | | | [0.50] | | | | [0.49] | | | |
| $\overline{D}_{-ig}$: Peers' mean no. of coupons received – first three season | 1.78 | 1.65 | 1.88 | 781 | 1.57 | 1.35 | 2.00 | 398 | 1.71 | 1.35 | 2.00 | 1179 |
| | [0.04] | | | | [0.09] | | | | [0.12] | | | |
| $\bar{I}_{-ig}$: Peers' any insurance purchase – first three seasons | 0.41 | 0.13 | 0.79 | 781 | 0.45 | 0.00 | 1.00 | 398 | 0.42 | 0.00 | 1.00 | 1179 |
| | [0.16] | | | | [0.17] | | | | [0.17] | | | |
| Peers' average: Male headed household (=1) | 0.63 | 0.00 | 0.88 | 781 | 0.79 | 0.50 | 1.00 | 398 | 0.68 | 0.00 | 1.00 | 1179 |
| | [0.25] | | | | [0.09] | | | | [0.22] | | | |
| Peers' average: Age of the household head | 48.08 | 27.19 | 59.14 | 781 | 50.23 | 37.11 | 57.03 | 398 | 48.81 | 27.19 | 59.14 | 1179 |
| | [6.14] | | | | [4.55] | | | | [5.74] | | | |
| Peers' average: Share of male children | 0.52 | 0.38 | 0.64 | 781 | 0.49 | 0.21 | 0.65 | 398 | 0.51 | 0.21 | 0.65 | 1179 |
| | [0.06] | | | | [0.07] | | | | [0.07] | | | |
| Peers' average: Head ever went to school (=1) | 0.13 | 0.00 | 0.31 | 781 | 0.11 | 0.00 | 0.30 | 398 | 0.13 | 0.00 | 0.31 | 1179 |
| | [0.09] | | | | [0.09] | | | | [0.09] | | | |
| Peers' average: Fully settled (=1) | 0.23 | 0.00 | 0.92 | 781 | 0.76 | 0.00 | 0.95 | 398 | 0.41 | 0.00 | 0.95 | 1179 |
| | [0.23] | | | | [0.13] | | | | [0.32] | | | |
| Peers' average: Adult equivalent | 4.68 | 3.59 | 6.37 | 781 | 4.94 | 3.90 | 6.30 | 398 | 4.77 | 3.59 | 6.37 | 1179 |
| | [0.55] | | | | [0.44] | | | | [0.53] | | | |
| Observations | 781 | | | | 398 | | | | 1179 | | | |

Notes: All columns present mean, standard deviation (in square brackets), and the number of observations for each variable.

Table B2: Spillover effects: First stage and mechanical correlation

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

Notes: The table presents the effects of number of coupons received by recipients and peers in the first three seasons on coupon received status and any insurance purchase in the first three seasons for both recipients and peers. Column (1) and (2) shows the mechanical correlation of number of coupons received in the first three seasons between the recipients and peers. Column (3)-(8) show the spillover effects from peers (recipients) coupon receipts on recipients (peers) insurance purchase. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for column (1) and (2), and mean outcomes for those who did not purchase any insurance in the first three seasons for Column (3)-(8). Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table B3: Spillover effects on prespecified primary outcomes: Herd size, earnings, education

| | Herd size (CMVE) | | | Annual household cash earnings (USD) | | | Share of members who completed age-appropriate years of education | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| $\widehat{I_{ij}}$: Any insurance purchase - first three seasons | 4.246 | 5.993 | 1.822 | 0.023 | 7.840 | 10.333 | 0.139 | 0.147 | 0.150$^{*}$ |
| | (11.012) | (10.628) | (8.917) | (220.714) | (224.607) | (212.845) | (0.090) | (0.090) | (0.088) |
| $\hat{\hat{I}}_{-ij}$: Peers' any insurance purchase – first three season | 131.264$^{**}$ | 111.870$^{***}$ | 15.771 | 589.876 | -569.251 | 762.414 | -0.268 | -0.376 | -0.057 |
| | (54.730) | (41.550) | (15.849) | (1000.537) | (1217.766) | (501.433) | (0.815) | (0.873) | (0.302) |
| Recipient controls (i) | | ✓ | | | ✓ | | | ✓ | |
| Peers' controls (-i) | | | ✓ | | | ✓ | | | ✓ |
| Control mean | 14.265 | 14.265 | 14.265 | 529.673 | 529.673 | 529.673 | 0.115 | 0.115 | 0.115 |
| Village FE | | | | | | | | | |
| Observations | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 762 | 762 | 762 |

Notes: The table presents Local Average Treatment Effects of any insurance purchase in the first three seasons of recipients and peers, instrumented by the number of discount coupons received in the first three seasons of recipients and peers on pre-specified primary outcomes. The dependent variable "herd size" is measured as the number of livestock herds expressed in CMVE, "cash earnings" is measured as self-reported seasonal main 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 "share of members who are age-appropriate education" is the share of household members who are in age-appropriate education for the cohorts who were school-aged during experiments. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 762 of the 1179 households for column (5) and (6) excluding households that do not have relevant cohort members within the households. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep. Please refer to Table 1 for the definition of outcome variables.

## Table B4: Spillover effects on Prespecified primary outcome: 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) | (9) | (10) | (11) | (12) |
| $\widehat{I_{ij}}$: Any insurance purchase - first three seasons | 0.098 | 0.090 | 0.131 | 0.175 | 0.186 | 0.119 | -0.261 | -0.261 | -0.240** | -0.030 | -0.008 | -0.009 |
| | (0.152) | (0.099) | (0.096) | (1.747) | (0.487) | (0.087) | (0.193) | (0.200) | (0.105) | (0.135) | (0.091) | (0.053) |
| $\hat{\bar{I}}_{-ij}$: Peers' any insurance purchase – first three season | -2.474** | -0.637 | -0.056 | 32.427 | 8.798 | 0.454 | -2.534*** | -2.636*** | -0.328 | -2.356 | -1.430 | -0.168 |
| | (1.232) | (0.536) | (0.256) | (69.077) | (6.668) | (0.312) | (0.886) | (0.925) | (0.300) | (2.079) | (0.908) | (0.159) |
| Recipient controls (i) | | ✓ | | | ✓ | | | ✓ | | | ✓ | |
| Peers' controls (-i) | | | ✓ | | | ✓ | | | ✓ | | | ✓ |
| Control mean | 0.263 | 0.263 | 0.263 | 0.332 | 0.332 | 0.332 | 0.284 | 0.284 | 0.284 | 0.121 | 0.121 | 0.121 |
| Village FE | | | | | | | | | | | | |
| Observations | 987 | 987 | 987 | 987 | 987 | 987 | 987 | 987 | 987 | 987 | 987 | 987 |

Notes: The table presents Local Average Treatment Effects of any insurance purchase in the first three seasons of recipients and peers, instrumented by the number of discount coupons received in the first three seasons of recipients and peers on pre-specified primary outcomes. 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 blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 987 of the 1179 households excluding households that are not currently herding any livestock. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

## Table B5: Spillover effects on prespecified secondary outcomes

| | Herd management expenditure (USD) | | | Milk Income | | | Livestock loss (CMVE) | | | Distress sales (CMVE) | | | Livestock Sale (CMVE) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
| $\widehat{I_{ij}}$: Any insurance purchase - first three seasons | 35.429 | 29.961 | 3.234 | 205.089 | 284.159 | 318.589 | 5.267 | 5.307 | 1.690 | 0.393 | 0.047 | -0.143 | -0.793 | -0.716 | -1.045 |
| | (113.562) | (98.475) | (90.355) | (516.843) | (454.177) | (402.867) | (7.473) | (7.371) | (2.594) | (1.559) | (1.129) | (0.576) | (1.677) | (1.690) | (1.471) |
| $\hat{\bar{I}}_{-ij}$: Peers' any insurance purchase – first three season | 1489.534** | 861.249 | 157.762 | -6687.054*** | -3554.462*** | -99.560 | 136.511*** | 130.911*** | 6.712 | 29.887** | 21.145*** | 7.601*** | 17.302*** | 18.314*** | 8.035* |
| | (674.661) | (624.342) | (300.905) | (2005.814) | (1246.619) | (534.801) | (35.796) | (37.465) | (25.017) | (12.457) | (7.733) | (2.364) | (6.239) | (6.340) | (4.161) |
| Recipient controls (i) | | ✓ | | | ✓ | | | ✓ | | | ✓ | | | ✓ | |
| Peers' controls (-i) | | | ✓ | | | ✓ | | | ✓ | | | ✓ | | | ✓ |
| Control mean | 167.891 | 167.891 | 167.891 | 359.879 | 359.879 | 359.879 | 5.448 | 5.448 | 5.448 | 0.292 | 0.292 | 0.292 | 1.872 | 1.872 | 1.872 |
| Village FE | | | | | | | | | | | | | | | |
| Observations | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 781 | 781 | 781 | 1179 | 1179 | 1179 |

Notes: The table presents Local Average Treatment Effects of any insurance purchase in the first three seasons of recipients and peers, instrumented by the number of discount coupons received in the first three seasons of recipients and peers on pre-specified primary outcomes. The dependent variable "herd management expenditure" is measured as the expenditure for herd management such as fodder expressed 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, and "livestock sale" is measured as sales for livestock expressed in CMVE. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 781 of the 1179 households for column (7) and (8) excluding households who are missing. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table B6: Spillover effects on 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 full-time | | | Working part-time | | | Studying full-time | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
| $\widehat{I_{ij}}$: Any insurance purchase - first three seasons | 0.102 | 0.098 | 0.043 | -0.164 | -0.172 | -0.783 | -0.206 | -0.157 | -0.956 | -0.894 | -0.978 | 0.758 | 6.858 | 0.905 | 0.225 |
| | (0.158) | (0.147) | (0.058) | (1.926) | (1.956) | (0.977) | (0.731) | (0.686) | (3.578) | (2.249) | (1.812) | (4.101) | (527.741) | (2.251) | (1.039) |
| $\hat{\hat{I}}_{-ij}$: Peers' any insurance purchase – first three season | 2.978$^{***}$ | 2.685$^{***}$ | 0.673$^{***}$ | 35.806$^{***}$ | 35.566$^{***}$ | 11.568$^{*}$ | 2.629 | 2.923 | -15.686 | -11.805 | -8.557 | 20.490 | 204.618 | 7.843 | -5.968 |
| | (0.808) | (0.783) | (0.238) | (11.250) | (13.378) | (5.971) | (14.857) | (6.812) | (91.142) | (21.258) | (11.523) | (88.287) | (16604.938) | (29.073) | (28.334) |
| Recipient controls (i) | | ✓ | | | ✓ | | | ✓ | | | ✓ | | | ✓ | |
| Peers' controls (-i) | | | ✓ | | | ✓ | | | ✓ | | | ✓ | | | ✓ |
| Control mean | 0.042 | 0.042 | 0.042 | 0.539 | 0.539 | 0.539 | 0.271 | 0.271 | 0.271 | 0.201 | 0.201 | 0.201 | 0.232 | 0.232 | 0.232 |
| village FE | | | | | | | | | | | | | | | |
| Observations | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 376 | 376 | 376 | 376 | 376 | 376 | 376 | 376 | 376 |

Notes: The table presents Local Average Treatment Effects of any insurance purchase in the first three seasons of recipients and peers, instrumented by the number of discount coupons received in the first three seasons of recipients and peers on pre-specified primary outcomes. The dependent variable "IBLI uptake" is measured by the uptake in the last 12 months before the endline survey evaluated by the dummy and CMVE, respectively, and children's time use as the share of children aged 5-17 who study full-time, work part-time, and study full-time, respectively. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Columns (5) to (10) report the estimated coefficients with 376 observations, which is also due to the absence of this information in Kenyan sample at the endline. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

# C Tables and Figures Referenced in Text

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] | | | |
| Share of members who completed age-appropriate years of education | 0.12 | 0.00 | 1.00 | 701 | 0.16 | 0.00 | 1.00 | 190 | 0.13 | 0.00 | 1.00 | 891 |
| | [0.24] | | | | [0.35] | | | | [0.27] | | | |
| 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 | 85.18 | 0.00 | 2125.04 | 398 | 387.12 | 0.00 | 21957.05 | 1179 |
| | [1361.23] | | | | [246.72] | | | | [1137.50] | | | |
| 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] | | | |
| N 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 deviation (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=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 (%) | | | |
|---|---|---|---|---|
| Number of coupons recipient's received | 0 | 1 | 2 | 3 |
| 0 | 80.000 | 16.250 | 3.750 | 0.000 |
| 1 | 67.797 | 27.119 | 4.802 | 0.282 |
| 2 | 51.646 | 38.821 | 9.185 | 0.347 |
| 3 | 48.214 | 34.524 | 17.262 | 0.000 |

| | Number of seasons purchase IBLI (%) | |
|---|---|---|
| Number of coupons recipient's received | 0 | 1 |
| 0 | 80.000 | 20.000 |
| 1 | 67.797 | 32.203 |
| 2 | 51.646 | 48.354 |
| 3 | 48.214 | 51.786 |

Notes: This table shows the relationship between number of coupons recipient's received and number of seasons purchase IBLI expressed in % terms in the initial three seasons.

## Table C3: Effects on income

| | Aggregate | Mutually exclusive categories (USD) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Annual total household income (USD) | Annual in-kind milk income (USD) | Annual earnings from milk (USD) | Annual in-kind slaughter income (USD) | Annual earnings from slaughter (USD) | Annual animal birth income (USD) | Annual in-kind crop income (USD) | Annual earnings income from crop (USD) | Annual employment (food for work) income (USD) | Annual earnings from the rest (USD) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Any insurance purchased | 352.660 | 313.145 | 67.790 | -20.556 | 51.142 | -39.456 | 48.641*** | 4.041 | -11.043 | -46.675 |
| | (519.093) | (310.904) | (158.605) | (37.165) | (35.010) | (97.891) | (17.186) | (29.899) | (8.964) | (204.839) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 1082.818 | 84.062 | 275.816 | 45.156 | 28.629 | 134.929 | 10.346 | 15.679 | 2.835 | 485.365 |
| Observations | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 |

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. The dependent variable of column (1) is aggregated annual total household income (sum of column (2)-(10) expressed in USD. The dependent variables of column (2)-(10) are annual income from each category expressed in USD. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. Please refer to Appendix Table E6 and Appendix Table E7 for the definition of outcome variables.

## Table C4: Effects on income - extensive margin

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

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. The dependent variable of column (1) is a dummy variable taking 1 if aggregated annual total household income (sum of column (2)-(10) expressed in USD is positive. The dependent variables of column (2)-(10) are the dummy variables taking 1 if annual income from each category expressed in USD is positive. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row “Control Mean” indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. Please refer to Appendix Table E6 and Appendix Table E7 for the definition of outcome variables.

Table C5: Effects on aggregated income

| | Annual income (USD) | | = 1 if the outcome > 0 | |
|---|---|---|---|---|
| | Total livestock income | Total crop income | Extensive margin – Annual total livestock income | Extensive margin - Annual total crop income |
| | (1) | (2) | (3) | (4) |
| Any insurance purchased | 367.836 | 53.291 | 0.072 | 0.090 |
| | (447.053) | (35.081) | (0.111) | (0.087) |
| Controls | ✓ | ✓ | ✓ | ✓ |
| Control mean | 568.593 | 26.026 | 0.798 | 0.117 |
| Observations | 1179 | 1179 | 1179 | 1179 |

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 aggregated income outcomes. The dependent variables of column (1) and column (3) are annual total livestock income expressed in USD and a dummy, respectively, while the ones in column (2) and column (4) are annual total crop income expressed in USD and a dummy, respectively. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. Please refer to Appendix Table E6 and Appendix Table E7 for the definition of outcome variables.

Table C6: Education - School-aged during experiment

| | Maximum years of education | Total years of education | Average years of education |
|---|---|---|---|
| | (1) | (2) | (3) |
| Any insurance purchased | 1.964 | 4.842 | 2.303** |
| | (1.348) | (3.025) | (1.112) |
| Controls | ✓ | ✓ | ✓ |
| Control mean | 6.715 | 8.488 | 4.860 |
| Observations | 770 | 1179 | 770 |

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. The dependent variable is "Maximum years of education", "total years of education", and "average years of education" among household members who are school-aged during experiment (6-18 in Kenya and 7-19 in Ethiopia). Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 770 of the 1179 households for column (1) and (3) excluding households that do not have relevant cohort members within the households. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table C7: Education - not yet school age during the experiment but were at endline

| | Share of age-appropriate education | Maximum years of education | Total years of education | Average years of education |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Any insurance purchased | -0.138 | 0.204 | -0.441 | 0.106 |
| | (0.129) | (0.625) | (0.742) | (0.460) |
| Baseline outcome | | | | |
| Controls | ✓ | ✓ | ✓ | ✓ |
| Control mean | 0.260 | 1.891 | 1.738 | 1.335 |
| Observations | 885 | 885 | 1179 | 885 |

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. The dependent variable is "share of age-appropriate education", "Maximum years of education", "total years of education", and "average years of education" among household members who were not yet school-aged during experiment (6-18 in Kenya and 7-19 in Ethiopia) but were at endline. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 770 of the 1179 households for column (1), (2), and (4) excluding households that do not have relevant cohort members within the households. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table C8: Effects on various measures of educational attainment

| | | | | Share of household members | | | | |
|---|---|---|---|---|---|---|---|---|
| | Maximum years of education | Total years of education | Average years of education | who completed age-appropriate years of education | who completed any schooling | who completed 4 years of primary education | who completed primary education | who completed secondary education |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Any insurance purchased | 1.964 | 4.842 | 2.303** | 0.168** | 0.208* | 0.162 | 0.142 | 0.002 |
| | (1.348) | (3.025) | (1.112) | (0.084) | (0.122) | (0.126) | (0.111) | (0.049) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 6.715 | 8.488 | 4.860 | 0.115 | 0.646 | 0.549 | 0.204 | 0.033 |
| Observations | 770 | 1179 | 770 | 762 | 770 | 770 | 770 | 770 |

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. The dependent variable is "Maximum years of education", "total years of education", "average years of education", share of household members "who completed age-appropriate years of education", "who completed any schooling", "who completed 4 years of primary education", "who completed primary education", and "who completed secondary education". Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 762 or 770 of the 1179 households except for column (2) excluding households that do not have relevant cohort members within the households. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table C9: Effects on educational attainment by gender

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

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. The dependent variable is “share of members who completed age-appropriate education”, “Maximum years of education”, “total years of education”, “average years of education”. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 762 or 770 of the 1179 households except for column (2) excluding households that do not have relevant cohort members within the households. The row “Control Mean” indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table C10: Effects on the number of young adults (18-25 years old, Kenya only)

| | N of young adults | | Share of young adults | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Any insurance purchased | 0.206 | 0.090 | | |
| | (0.311) | (0.274) | | |
| Baseline N of young adults | 0.040 | -0.221*** | | |
| | (0.039) | (0.041) | | |
| Adult equivalent | | 0.268*** | | 0.023*** |
| | | (0.023) | | (0.004) |
| Baseline average education of young adults | | | 0.012*** | 0.007*** |
| | | | (0.002) | (0.002) |
| Baseline share of young adults | | | -0.251*** | -0.144*** |
| | | | (0.040) | (0.043) |
| Controls | | ✓ | | ✓ |
| Control mean | 0.774 | 0.774 | | |
| Observations | 781 | 781 | 479 | 479 |

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. The dependent variable is "number of young adults" and "share of young adults". Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table C11: Herd composition large versus small ruminants - short-run and long-run

| | N of animals (CMVE) / Total herd size (CMVE) | | | | | |
|---|---|---|---|---|---|---|
| | Camels and cattle | | | Goats and sheep | | |
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Any insurance purchased | 0.071 | 0.124 | 0.230** | -0.071 | -0.124 | -0.230** |
| | (0.071) | (0.090) | (0.115) | (0.071) | (0.090) | (0.115) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 0.669 | 0.643 | 0.596 | 0.331 | 0.357 | 0.404 |
| Observations | 1085 | 1009 | 987 | 1085 | 1009 | 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 third sales season, ii) after the end of the experiment (sixth sales season), and iii) at the 10-year follow up. The dependent variable “herd composition” is measured as the number of animals of camels and cattle, and goats and sheep, 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 individual-level, as this was the level of randomization. Data includes sub populaation of the 1179 households excluding households that are not herding the livestock. The row “Control Mean” indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table C12: Herd size, earnings, and education —short-run and long-run

| | Herd size (CMVE) | | | Total household cash earning (USD) | | | Share of members who completed age-appropriate years of education | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Any insurance purchased | -4.292 | -0.765 | 3.308 | 73.840 | 65.205 | 5.497 | -0.013 | 0.089* | 0.168** |
| | (6.122) | (5.580) | (8.856) | (112.952) | (167.282) | (209.810) | (0.031) | (0.047) | (0.084) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 20.648 | 17.931 | 14.265 | 421.759 | 629.263 | 529.673 | 0.038 | 0.050 | 0.115 |
| Observations | 1165 | 1118 | 1179 | 1165 | 1118 | 1179 | 955 | 921 | 762 |

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 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. The dependent variable "herd size" is measured as the number of livestock herds expressed in CMVE, "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 "share of members who are age-appropriate education" is the share of household members who are in age-appropriate education for the cohorts who were school-aged during experiments. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep. Please refer to Table 1 for the definition of outcome variables.

Table C13: Education - short-run and long-run

| | Maximum years of education | | | Total years of education | | | Average years of education | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Any insurance purchased | -0.032 | 0.812 | 1.964 | -0.543 | -0.012 | 4.842 | -0.046 | 0.219 | 2.303** |
| | (0.601) | (0.889) | (1.348) | (0.896) | (1.941) | (3.025) | (0.252) | (0.561) | (1.112) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 1.212 | 4.712 | 6.715 | 1.617 | 8.023 | 8.488 | 0.487 | 2.119 | 4.860 |
| Observations | 982 | 948 | 770 | 1165 | 1118 | 1179 | 982 | 948 | 770 |

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 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. The dependent variable is "Maximum years of education", "total years of education", and "average years of education" among household members who are school-aged during experiment (6-18 in Kenya and 7-19 in Ethiopia). Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table C14: Herd composition — short-run and long-run

| | Outcome: N of animal type in CMVE / Total N of animals in CMVE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Camel | | | Cattle | | | Goat | | | Sheep | | |
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Any insurance purchased | 0.083 | 0.075 | 0.120 | -0.010 | 0.052 | 0.107 | -0.044 | -0.173** | -0.235** | -0.027 | 0.057 | 0.009 |
| | (0.060) | (0.074) | (0.092) | (0.059) | (0.070) | (0.083) | (0.066) | (0.073) | (0.097) | (0.032) | (0.051) | (0.052) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 0.301 | 0.258 | 0.263 | 0.369 | 0.385 | 0.332 | 0.221 | 0.228 | 0.284 | 0.109 | 0.128 | 0.121 |
| Observations | 1085 | 1009 | 987 | 1085 | 1009 | 987 | 1085 | 1009 | 987 | 1085 | 1009 | 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 third sales season, ii) after the end of the experiment (sixth sales season), and iii) at the 10-year follow up. 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 blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table C15: Herd management expenditure and milk income — short-run and long-run

| | Herd management expenditure (USD) | | | Annual milk income (USD) | | |
|---|---|---|---|---|---|---|
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Any insurance purchased | 483.665 | 378.105 | 2.634 | 20.828 | 230.424 | 377.169 |
| | (3445.306) | (1732.750) | (89.841) | (238.605) | (244.888) | (401.425) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 3489.562 | 2370.027 | 167.891 | 386.486 | 414.137 | 359.879 |
| Observations | 1156 | 1118 | 1179 | 1165 | 1118 | 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 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. The dependent variable “herd management expenditure” is measured as the expenditure for herd management such as fodder expressed in USD, “milk income” is measured as the cash and in-kind income from milk expressed in USD. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row “Control Mean” indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table C16: Distress sale and livestock sale — short-run and long-run

| | Distress sales (CMVE) | | | Livestock sale (CMVE) | | |
|---|---|---|---|---|---|---|
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Any insurance purchased | 0.332 | -0.037 | -0.389 | -1.189 | 0.957 | -1.078 |
| | (1.741) | (4.054) | (0.532) | (2.595) | (4.210) | (1.449) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 2.669 | 4.045 | 0.292 | 6.605 | 8.775 | 1.872 |
| Observations | 1096 | 1089 | 781 | 1096 | 1089 | 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 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. The dependent variable "distress sales" is measured as sales of livestock to cope with drought expressed in CMVE, and "livestock sale" is measured as sales for livestock expressed in CMVE. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

## Table C17: Livestock loss by animal type — short-run and long-run

| | N of lost animals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Camel | | | Cattle | | | Goats/Sheep | | |
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Any insurance purchased | -0.507 | 0.224 | 0.245 | 0.299 | -0.803 | 1.169 | 15.776 | 0.684 | -7.142 |
| | (1.233) | (0.382) | (1.119) | (2.037) | (0.813) | (2.014) | (12.147) | (5.489) | (9.452) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 1.832 | 0.585 | 0.982 | 2.058 | 1.110 | 3.539 | 19.940 | 9.337 | 11.788 |
| Observations | 943 | 823 | 896 | 943 | 823 | 896 | 943 | 823 | 896 |

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 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. The dependent variable "number of livestock loss" is measured as the loss of each species of livestock such as death. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table C18: Time use of children -— short-run and long-run

| | Working full-time | | | Working part-time | | | Studying full-time | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run | 3rd sales season | End of experiment | 10-year long-run |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Any insurance purchased | -0.074 | -0.001 | -0.322 | 0.159 | 0.105 | -0.261 | -0.131 | -0.114 | 0.467* |
| | (0.097) | (0.088) | (0.280) | (0.103) | (0.098) | (0.254) | (0.096) | (0.089) | (0.278) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 0.427 | 0.409 | 0.271 | 0.289 | 0.291 | 0.201 | 0.177 | 0.167 | 0.232 |
| Observations | 1040 | 1030 | 376 | 1040 | 1030 | 376 | 1040 | 1030 | 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 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. The dependent variable is "children's time use" as the share of children aged 5-17 who study full-time, work part-time, and study full-time, respectively. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Columns (3), (6), and (9) report the estimated coefficients with 376 observations, which is also due to the absence of this information in Kenyan sample at the endline. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance.

Table C19: Payout effect on herd size, earnings, education

| | Herd size (CMVE) | | Annual household cash earnings (USD) | | Share of members who completed age-appropriate years of education | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Any insurance purchased ($\gamma_1$) | 2.010 | 3.468 | -3.790 | 9.794 | 0.184** | 0.180** |
| | (9.019) | (9.169) | (215.4) | (215.3) | (0.0909) | (0.0870) |
| Any insurance purchased × Indemnity rate ($\gamma_2$) | 7.086 | -16.47 | -295.6 | -439.8 | -1.217 | -1.277 |
| | (41.84) | (38.79) | (2514.4) | (2344.3) | (0.957) | (0.998) |
| Coef: $\gamma_1 + \gamma_2$ | 9.096 | -13.002 | -299.383 | -429.972 | -1.033 | -1.097 |
| p-val.: $\gamma_1 + \gamma_2$ | 0.917 | 0.681 | 0.910 | 0.851 | 0.157 | 0.261 |
| Controls | | ✓ | | ✓ | | ✓ |
| Control mean | 14.265 | 14.265 | 529.673 | 529.673 | 0.115 | 0.115 |
| Observations | 1179 | 1179 | 1179 | 1179 | 762 | 762 |

Notes: The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons and their predicted payouts, 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 herds expressed in CMVE, "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 "share of members who are age-appropriate education" is the share of household members who are in age-appropriate education for the cohorts who were school-aged during experiments. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 762 of the 1179 households for column (5) and (6) excluding households that do not have relevant cohort members within the households. The row labeled 'Coef' displays the effects of the payout, and the row labeled 'p-value' shows its statistical significance. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep. Please refer to Table 1 for the definition of outcome variables.

Table C20: Payout effect on herd composition

| | Outcome: N of animal type in CMVE / Total N of animals in CMVE | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Camel | | Cattle | | Goats | | Sheep | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Any insurance purchased ($\gamma_1$) | 0.121 | 0.118 | 0.116 | 0.115 | -0.231** | -0.242** | -0.00900 | 0.00841 |
| | (0.0930) | (0.0935) | (0.0832) | (0.0832) | (0.0974) | (0.0989) | (0.0537) | (0.0531) |
| Any insurance purchased × Indemnity rate ($\gamma_2$) | 0.204 | 0.180 | -0.816 | -0.785 | 0.671 | 0.780 | 0.168 | 0.0186 |
| | (0.816) | (0.791) | (1.495) | (1.538) | (1.211) | (1.228) | (0.294) | (0.224) |
| Coef: $\gamma_1 + \gamma_2$ | 0.325 | 0.298 | -0.700 | -0.670 | 0.440 | 0.538 | 0.159 | 0.027 |
| p-val.: $\gamma_1 + \gamma_2$ | 0.922 | 0.697 | 0.536 | 0.662 | 0.464 | 0.658 | 0.585 | 0.890 |
| Controls | | ✓ | | ✓ | | ✓ | | ✓ |
| Control mean | 0.263 | 0.263 | 0.332 | 0.332 | 0.284 | 0.284 | 0.121 | 0.121 |
| 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 and their predicted payouts, instrumented by the number of discount coupons received in the first three seasons on pre-specified primary outcomes. 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 blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 987 of the 1179 households excluding households that are not currently herding any livestock. The row labeled 'Coef' displays the effects of the payout, and the row labeled 'p-value' shows its statistical significance. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table C21: Payout effects on secondary outcomes: Herd management expenditure and milk income

| | Herd management expenditure (USD) | | Milk Income | | Livestock loss (CMVE) | | Distress sales (CMVE) | | Livestock Sale (CMVE) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Any insurance purchased ($\gamma_1$) | 1.209 | 3.744 | 348.4 | 418.0 | 1.597 | 1.669 | -0.345 | -0.404 | -1.330 | -1.210 |
| | (94.65) | (94.93) | (406.9) | (416.0) | (2.977) | (2.873) | (0.552) | (0.557) | (1.501) | (1.492) |
| Any insurance purchased × Indemnity rate ($\gamma_2$) | 145.4 | -113.6 | -3802.3** | -4170.2** | 22.44 | 17.48 | 1.221 | 1.291 | 19.25 | 13.53 |
| | (1310.3) | (1332.5) | (1924.8) | (1933.9) | (27.40) | (21.27) | (1.991) | (2.373) | (15.36) | (12.05) |
| Coef: $\gamma_1 + \gamma_2$ | 146.620 | -109.817 | -3453.891 | -3752.237 | 24.039 | 19.153 | 0.876 | 0.887 | 17.922 | 12.316 |
| p-val.: $\gamma_1 + \gamma_2$ | 0.915 | 0.932 | 0.065 | 0.022 | 0.466 | 0.347 | 0.537 | 0.642 | 0.196 | 0.285 |
| Controls | | ✓ | | ✓ | | ✓ | | ✓ | | ✓ |
| Control mean | 167.891 | 167.891 | 359.879 | 359.879 | 5.448 | 5.448 | 0.292 | 0.292 | 1.872 | 1.872 |
| Observations | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 781 | 781 | 1179 | 1179 |

Notes:The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons and their predicted payouts, instrumented by the number of discount coupons received in the first three seasons on pre-specified primary outcomes. The dependent variable "herd management expenditure" is measured as the expenditure for herd management such as fodder expressed 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, and "livestock sale" is measured as sales for livestock expressed in CMVE. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Data includes 781 of the 1179 households for column (7) and (8) excluding households who are missing. The row labeled 'Coef' displays the effects of the payout, and the row labeled 'p-value' shows its statistical significance. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table C22: Payout effects on secondary outcomes: IBLI purchase

| | IBLI uptake in the past 12 months (=1 if purchased) | | IBLI uptake in the past 12 months (CMVE) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Any insurance purchased ($\gamma_1$) | 0.0346 | 0.0375 | -1.005 | -0.993 |
| | (0.0446) | (0.0450) | (0.926) | (0.982) |
| Any insurance purchased × Indemnity rate ($\gamma_2$) | -0.123 | -0.162 | 3.273 | 4.453 |
| | (0.155) | (0.171) | (3.184) | (4.634) |
| Coef: $\gamma_1 + \gamma_2$ | -0.088 | -0.124 | 2.268 | 3.460 |
| p-val.: $\gamma_1 + \gamma_2$ | 0.428 | 0.355 | 0.296 | 0.358 |
| Controls | | ✓ | | ✓ |
| Control mean | 0.042 | 0.042 | 0.539 | 0.539 |
| Observations | 1179 | 1179 | 1179 | 1179 |

Notes::The table presents estimated Local Average Treatment Effects of any insurance purchase in the first three seasons and their predicted payouts, instrumented by the number of discount coupons received in the first three seasons on pre-specified primary outcomes. The dependent variable "IBLI uptake" is measured by the uptake in the last 12 months before the endline survey evaluated by the dummy and CMVE, respectively. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. Columns (5) to (10) report the estimated coefficients with 376 observations, which is also due to the absence of this information in Kenyan sample at the endline. The row labeled 'Coef' displays the effects of the payout, and the row labeled 'p-value' shows its statistical significance. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

Table C23: Number of animals by animal type

| | N of animals (CMVE) | | | | Raw N of animals | | | |
|---|---|---|---|---|---|---|---|---|
| | Camel | Cattle | Goat | Sheep | Camel | Cattle | Goat | Sheep |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Any insurance purchased | 1.680 | -1.117 | -0.486 | -0.256 | 0.953 | -1.117 | -6.401 | -3.332 |
| | (4.479) | (4.879) | (0.937) | (0.578) | (2.746) | (4.879) | (7.910) | (5.221) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 10.678 | 7.455 | 3.525 | 3.417 | 6.471 | 7.455 | 23.266 | 22.666 |
| Observations | 1179 | 1179 | 1179 | 1179 | 1179 | 1179 | 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 the number of animals. The dependent variables for column (1)-(4) present the number of each animal type expressed by CMVE, while column (5)-(8) present the raw number of each livestock. Community fixed effects are included as randomization blocked at community level. Standard errors are clustered at the individual-level, as this was the level of randomization. The row "Control Mean" indicates mean outcomes for those who did not purchase any insurance in the first three seasons. Control variables include a dummy for male head, age of household head, share of male children, a dummy indicating whether the household head ever went to school, a dummy for whether the household is fully settled, and household size in adult equivalents. Stars indicate: *** 1 percent ** 5 percent * 10 percent level of significance. In Kenya, 1 CMVE= 0.625 camel=1 cattle=10 goats/sheep, and in Ethiopia, 1 CMVE=4 camel=1 cattle=6.25 goats/sheep.

# Online Appendix

## D Robustness Check

### D.1 Herd size, livestock loss, animals insured in TLU (in contrast to 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 D1 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 D2 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 D1: Effects on livestock measured by TLU

| | | N of animal type / Total N of animals (CMVE) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 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 | 3.087 | 0.107 | 0.124 | -0.237** | 0.005 | 0.691 | -0.326 | -1.216 | -0.448 |
| | (8.054) | (0.089) | (0.082) | (0.096) | (0.052) | (2.248) | (0.496) | (1.391) | (0.536) |
| Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Control mean | 12.922 | 0.249 | 0.363 | 0.270 | 0.117 | 5.109 | 0.287 | 1.689 | 0.319 |
| Observations | 1179 | 987 | 987 | 987 | 987 | 1124 | 781 | 1131 | 1179 |

Notes: All columns present coefficient estimates and robust standard errors (in parentheses) from the following equation: $y_{ijT} = \beta_0 + \beta_{LATE}\widehat{I}_{ij} + \beta_1 y_{ij0} + \beta_2 X_{ij0} + \beta_3 D^{t=6}_{ij4} + \rho_j + \varepsilon_{ijT}$. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. All columns include community fixed effects. Any insurance purchased refers to the act of purchasing insurance at least once, but up to three times, within the initial three seasons. 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=4 camel=1 cattle=6.25 goats/sheep. Please refer to Table C1 for the definition of outcome variables.

Table D2: 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 | 1.214 | 1.983 | 3.005* | 3.826* | 5.220 | 4.743 | 7.572 | 8.008 | 6.746 |
| | (1.213) | (1.453) | (1.686) | (2.027) | (4.190) | (4.162) | (14.474) | (19.975) | (15.652) |

Notes: All the columns include control variables. Control mean is 14.265. Sample size is 1179 across all the columns. The table shows the coefficient estimates from the following IV-quantile equation for every 10 percentile quantiles: $y_{ijT} = \beta_0 + \beta_{LATE}\widehat{I_{ij}} + \beta_1 y_{ij0} + \beta_2 X_{ij0} + \beta_3 D_{ij4}^{t=6} + \rho_j + \varepsilon_{ijT}$. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. All columns include community fixed effects. Any insurance purchased refers to the act of purchasing insurance at least once, but up to three times, within the initial three seasons. 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=4 camel=1 cattle=6.25 goats/sheep. Please refer to Table E6 for the definition of outcome variables.

# E Additional Tables and Figures Referenced in Text

Table E1: 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 |

# Table E2: Balance of coupon distribution in Kenya

| | Received coupon vs. No coupon | | | | | | |
|---|---|---|---|---|---|---|---|
| Sales Season: | 2010 JF | 2011 JF | 2011 AS | 2012 AS | 2013 JF | 2013 AS | F-test |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Age of the household head | 1.45 | 1.12 | 0.0112 | -0.276 | 1.24 | -2.39* | 7.25 |
| | (1.19) | (1.20) | (1.21) | (1.07) | (1.05) | (1.31) | {0.298} |
| | [0.0801] | [0.0553] | [0.00141] | [-0.0144] | [0.0754] | [-0.144] | |
| Male headed household (=1) | -0.0167 | -0.0141 | -0.0286 | -0.0309 | 0.0148 | -0.0293 | 3.52 |
| | (0.0296) | (0.0291) | (0.0291) | (0.0298) | (0.0304) | (0.0369) | {0.741} |
| | [-0.0349] | [-0.0343] | [-0.0556] | [-0.0585] | [0.0270] | [-0.0594] | |
| Education of household head | -0.281 | -0.0645 | -0.0430 | 0.122 | -0.261 | 0.290 | 5.42 |
| | (0.216) | (0.213) | (0.214) | (0.204) | (0.206) | (0.235) | {0.492} |
| | [-0.0884] | [-0.0156] | [-0.00885] | [0.0441] | [-0.0852] | [0.0942] | |
| Adult equivalent | 0.114 | 0.119 | -0.0305 | -0.0232 | -0.177 | -0.120 | 3.88 |
| | (0.130) | (0.136) | (0.136) | (0.137) | (0.134) | (0.180) | {0.693} |
| | [0.0564] | [0.0635] | [-0.0147] | [-0.00878] | [-0.0829] | [-0.0592] | |
| Dependency ratio | 0.00525 | -0.00582 | 0.00206 | 0.0223 | 0.00104 | -0.00847 | 3.38 |
| | (0.0143) | (0.0135) | (0.0137) | (0.0136) | (0.0129) | (0.0158) | {0.760} |
| | [0.0253] | [-0.0282] | [0.0130] | [0.113] | [0.00562] | [-0.0373] | |
| Herd size (CMVE) | 1.37 | -0.743 | 1.21 | -0.688 | 1.09 | -1.02 | 2.69 |
| | (2.02) | (2.00) | (1.83) | (1.38) | (1.11) | (1.64) | {0.847} |
| | [0.0316] | [-0.0178] | [0.0151] | [-0.0378] | [0.0605] | [-0.0514] | |
| Annual income per AE (USD) | -17.0 | -19.6 | -1.73 | 13.9 | 3.46 | -19.3 | 4.40 |
| | (13.1) | (19.5) | (18.2) | (14.1) | (17.1) | (24.5) | {0.623} |
| | [-0.0845] | [-0.0671] | [-0.00778] | [0.0632] | [0.0128] | [-0.0678] | |
| Own or farm agricultural land | -0.0215 | -0.0206 | 0.0428** | 0.0206 | -0.0227 | -0.00401 | 13.0 |
| | (0.0168) | (0.0160) | (0.0168) | (0.0179) | (0.0181) | (0.0234) | {0.0440} |
| | [-0.0394] | [-0.0566] | [0.131] | [0.0395] | [-0.0537] | [0.00644] | |
| F statistics of Joint F-test: | 6.785 | 5.215 | 9.014 | 7.057 | 7.741 | 7.754 | |
| P-value of Joint F-test: | 0.560 | 0.734 | 0.341 | 0.530 | 0.459 | 0.458 | |

Notes: Each cell reports the results from individual regression estimaing Equation (7):$y_{ijt} = \alpha + \beta_1 \text{Received Coupon}_{ijt} + \gamma_j + \varepsilon_{ijt}$, where $y_{ijt}$ denotes 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 and normalized difference (in square brackets) between the coupon recipients and non-recipients. All estimations include country and community fixed effects. Columns (1) to (6) report mean differences, robust standard errors (in parentheses), and and normalized difference (in square brackets) between the coupon recipients and non-recipients.Column (7) reports joint signifiance test for each variable across seasons where the first row presents the Chi-statistics and the second row presents the p-value of the test statistic in bracketsDependency ratio is the ratio of dependents – people younger than 15 or older than 64 – to the working-age population, those ages 15-64.See Table 1 notes for definitions of variables. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

## Table E3: Balance of coupon distribution in Ethiopia

| | Received coupon vs. No coupon | | | | | | |
|---|---|---|---|---|---|---|---|
| Sales Season: | 2012 AS | 2013 JF | 2013 AS | 2014 JF | 2014 AS | 2015 JF | F-test |
| | (1) | (2) | (3) | (4) | (5) | (6) | |
| Age of the household head | -2.23 | 2.11 | -0.939 | 0.825 | 1.39 | 4.27** | 8.37 |
| | (2.22) | (2.10) | (1.84) | (2.07) | (2.03) | (1.88) | {0.212} |
| | [-0.125] | [0.120] | [-0.0449] | [0.0426] | [0.0885] | [0.239] | |
| Male headed household (=1) | -0.0316 | -0.0631 | -0.0486 | -0.0546 | -0.0216 | -0.0182 | 6.21 |
| | (0.0450) | (0.0435) | (0.0433) | (0.0418) | (0.0437) | (0.0439) | {0.400} |
| | [-0.0810] | [-0.168] | [-0.126] | [-0.143] | [-0.0616] | [-0.0556] | |
| Education of household head | -0.115 | -0.0322 | -0.0341 | 0.00161 | -0.112 | -0.0191 | 1.75 |
| | (0.238) | (0.230) | (0.115) | (0.0886) | (0.0996) | (0.0727) | {0.941} |
| | [-0.0672] | [-0.0196] | [-0.0283] | [0.00246] | [-0.128] | [-0.0389] | |
| Adult equivalent | -0.359 | -0.127 | -0.319 | -0.00255 | -0.0307 | -0.181 | 4.43 |
| | (0.277) | (0.242) | (0.239) | (0.221) | (0.250) | (0.254) | {0.618} |
| | [-0.167] | [-0.0695] | [-0.160] | [0.00102] | [-0.0175] | [-0.0861] | |
| Dependency ratio | -0.0241 | 0.00260 | 0.0141 | -0.0139 | 0.0517*** | -0.0191 | 10.9 |
| | (0.0195) | (0.0207) | (0.0192) | (0.0173) | (0.0199) | (0.0196) | {0.0920} |
| | [-0.127] | [0.00747] | [0.0876] | [-0.0773] | [0.281] | [-0.108] | |
| Herd size (CMVE) | 0.473 | -1.43 | -4.26 | -3.17 | -1.26 | -3.89 | 3.47 |
| | (2.47) | (2.34) | (3.82) | (3.81) | (3.01) | (4.30) | {0.748} |
| | [0.00220] | [-0.0605] | [-0.156] | [-0.118] | [-0.0491] | [-0.127] | |
| Annual income per AE (USD) | 30.0*** | -4.73 | -7.54 | 3.58 | -19.0* | -21.2 | 13.4 |
| | (11.5) | (20.3) | (11.5) | (9.81) | (11.0) | (13.4) | {0.0370} |
| | [0.233] | [-0.0218] | [-0.0876] | [0.0223] | [-0.190] | [-0.193] | |
| Own or farm agricultural land | -0.0514 | 0.0457 | -0.0613* | 0.0260 | -0.00126 | -0.00522 | 5.81 |
| | (0.0468) | (0.0477) | (0.0356) | (0.0377) | (0.0327) | (0.0324) | {0.444} |
| | [-0.120] | [0.106] | [-0.112] | [0.0914] | [0.0277] | [0.00581] | |
| F statistics of Joint F-test: | 12.397 | 5.190 | 6.158 | 5.790 | 12.697 | 11.247 | |
| P-value of Joint F-test: | 0.134 | 0.737 | 0.629 | 0.671 | 0.123 | 0.188 | |

Notes: Each cell reports the results from individual regression estimaing Equation (7):$y_{ijt} = \alpha + \beta_1 \text{Received Coupon}_{ijt} + \gamma_j + \varepsilon_{ijt}$, where $y_{ijt}$ denotes 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 and normalized difference (in square brackets) between the coupon recipients and non-recipients. All estimations include country and community fixed effects. Columns (1) to (6) report mean differences, robust standard errors (in parentheses), and and normalized difference (in square brackets) between the coupon recipients and non-recipients.Column (7) reports joint signifiance test for each variable across seasons where the first row presents the Chi-statistics and the second row presents the p-value of the test statistic in bracketsDependency ratio is the ratio of dependents – people younger than 15 or older than 64 – to the working-age population, those ages 15-64.See Table 1 notes for definitions of variables. * denotes significance at 0.10; ** at 0.05; and *** at 0.01.

Table E4: First stage regression results

| | Number of seasons respondent purchased ANY IBLI – all six seasons | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pooled | | | | Kenya | | | | Ethiopia | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| Cum. coupon receipt (N) | 0.127*** | | | | 0.160*** | | | | 0.045 | | | |
| | (0.021) | | | | (0.024) | | | | (0.042) | | | |
| Coupon Receipt (Season 1) | | 0.256*** | | 0.156* | | 0.266*** | | 0.193* | | 0.188 | | 0.188 |
| | | (0.059) | | (0.087) | | (0.067) | | (0.114) | | (0.117) | | (0.149) |
| Coupon Receipt (Season 2) | | 0.169*** | | 0.075 | | 0.219*** | | 0.104 | | 0.004 | | -0.078 |
| | | (0.061) | | (0.084) | | (0.068) | | (0.109) | | (0.130) | | (0.161) |
| Coupon Receipt (Season 3) | | 0.120** | | 0.054 | | 0.245*** | | 0.191* | | -0.267** | | -0.372** |
| | | (0.059) | | (0.090) | | (0.067) | | (0.115) | | (0.120) | | (0.163) |
| Coupon Receipt (Season 4) | | 0.058 | | -0.067 | | 0.072 | | 0.025 | | -0.012 | | -0.223 |
| | | (0.059) | | (0.088) | | (0.068) | | (0.113) | | (0.115) | | (0.153) |
| Coupon Receipt (Season 5) | | 0.056 | | -0.107 | | 0.015 | | -0.090 | | 0.145 | | -0.064 |
| | | (0.061) | | (0.085) | | (0.070) | | (0.107) | | (0.127) | | (0.156) |
| Coupon Receipt (Season 6) | | 0.073 | | -0.037 | | 0.156** | | 0.119 | | -0.086 | | -0.301* |
| | | (0.066) | | (0.090) | | (0.074) | | (0.108) | | (0.129) | | (0.161) |
| Discount rate (Season 1) | | | 0.005*** | 0.003 | | | 0.006*** | 0.002 | | | 0.004** | 0.002 |
| | | | (0.001) | (0.002) | | | (0.002) | (0.003) | | | (0.002) | (0.003) |
| Discount rate (Season 2) | | | 0.003*** | 0.003 | | | 0.005*** | 0.003 | | | 0.002 | 0.002 |
| | | | (0.001) | (0.002) | | | (0.002) | (0.003) | | | (0.002) | (0.002) |
| Discount rate (Season 3) | | | 0.003** | 0.002 | | | 0.005*** | 0.002 | | | 0.000 | 0.003 |
| | | | (0.001) | (0.002) | | | (0.002) | (0.003) | | | (0.002) | (0.003) |
| Discount rate (Season 4) | | | 0.002* | 0.003* | | | 0.002 | 0.001 | | | 0.003 | 0.005** |
| | | | (0.001) | (0.002) | | | (0.002) | (0.003) | | | (0.002) | (0.002) |
| Discount rate (Season 5) | | | 0.003** | 0.004** | | | 0.001 | 0.003 | | | 0.004** | 0.005** |
| | | | (0.001) | (0.002) | | | (0.002) | (0.003) | | | (0.002) | (0.002) |
| Discount rate (Season 6) | | | 0.002** | 0.003* | | | 0.002* | 0.001 | | | 0.003 | 0.005** |
| | | | (0.001) | (0.001) | | | (0.001) | (0.002) | | | (0.002) | (0.002) |
| Effective F-stat | 35.965 | 5.809 | 7.930 | 4.664 | 43.297 | 8.033 | 6.768 | 4.220 | 1.129 | 1.514 | 2.527 | 2.550 |
| 10% Critical Value | 16.380 | 12.680 | 12.843 | 13.479 | 16.380 | 12.684 | 12.965 | 13.627 | 16.380 | 13.411 | 14.164 | 14.260 |
| N | 1179 | 1168 | 1168 | 1168 | 781 | 781 | 781 | 781 | 398 | 387 | 387 | 387 |

Notes: All columns present coefficient estimates and robust standard errors (in parentheses) from the following equations: $IBLI_{i,u,j} = \alpha^0 + \alpha^1 y_{i,u,j,t=0} + \alpha^2 x_{i,u,j,t=0} + \alpha^3 Discount_{i,u,j} + \gamma + \mu_{i,u,j}$, where $IBLI_{i,u,j} = \sum_{t\in[C]} I^{IBLI}_{i,u,j,t}$ where $I^{IBLI}_{i,u,j,t} = 1$ if $IBLI_{i,u,j,t} > 0$, $Discount_{i,u,j} = \sum_{t\in[C]} I^{Discount}_{i,u,j,t}$ where $I^{Discount}_{i,u,j,t} = 1$ if $Discount_{i,u,j,t} > 0$ and C=[2010JF, 2011JF, 2011AS, 2012AS, 2013JF, 2013AS in Kenya, and 2012AS, 2013JF, 2013AS, 2014JF, 2014AS, 2015JF in Ethiopia. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. All columns include country and community fixed effects. In columns (1), (5) and (9), the reported 10% critical values are from Stock and Yogo (2005) and in other columns they are from Olea and Pflueger (2013), which are the cutoffs that we compare effective F-statistics with to determine whether the instrument is weak.

Table E5: First stage – using coupon receipt status of individual sales season

| | Outcome: Respondent purchased ANY IBLI in each season | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Panel A: Pooled sample | | | | | | |
| Coupon Receipt (Season 1) | 0.236*** | | | | | |
| | (0.023) | | | | | |
| Coupon Receipt (Season 2) | | 0.078*** | | | | |
| | | (0.022) | | | | |
| Coupon Receipt (Season 3) | | | 0.128*** | | | |
| | | | (0.017) | | | |
| Coupon Receipt (Season 4) | | | | 0.067*** | | |
| | | | | (0.017) | | |
| Coupon Receipt (Season 5) | | | | | 0.070*** | |
| | | | | | (0.016) | |
| Coupon Receipt (Season 6) | | | | | | 0.058*** |
| | | | | | | (0.013) |
| Effective F-stat | 105.823 | 12.690 | 55.896 | 15.817 | 19.533 | 19.782 |
| 10% Critical Value | 16.380 | 16.380 | 16.380 | 16.380 | 16.380 | 16.380 |
| N | 1168 | 1168 | 1176 | 1175 | 1173 | 1171 |
| Panel B: Kenya | | | | | | |
| Coupon Receipt (Season 1) | 0.236*** | | | | | |
| | (0.027) | | | | | |
| Coupon Receipt (Season 2) | | 0.095*** | | | | |
| | | (0.025) | | | | |
| Coupon Receipt (Season 3) | | | 0.148*** | | | |
| | | | (0.021) | | | |
| Coupon Receipt (Season 4) | | | | 0.050** | | |
| | | | | (0.020) | | |
| Coupon Receipt (Season 5) | | | | | -0.001 | |
| | | | | | (0.016) | |
| Coupon Receipt (Season 6) | | | | | | 0.043*** |
| | | | | | | (0.012) |
| Effective F-stat | 77.545 | 14.627 | 49.695 | 6.225 | 0.008 | 13.244 |
| 10% Critical Value | 16.380 | 16.380 | 16.380 | 16.380 | 16.380 | 16.380 |
| N | 781 | 781 | 781 | 781 | 781 | 781 |
| Panel C: Ethiopia | | | | | | |
| Coupon Receipt (Season 1) | 0.233*** | | | | | |
| | (0.043) | | | | | |
| Coupon Receipt (Season 2) | | 0.022 | | | | |
| | | (0.045) | | | | |
| Coupon Receipt (Season 3) | | | 0.068*** | | | |
| | | | (0.026) | | | |
| Coupon Receipt (Season 4) | | | | 0.115*** | | |
| | | | | (0.030) | | |
| Coupon Receipt (Season 5) | | | | | 0.284*** | |
| | | | | | (0.034) | |
| Coupon Receipt (Season 6) | | | | | | 0.091*** |
| | | | | | | (0.033) |
| Effective F-stat | 29.017 | 0.238 | 7.062 | 14.461 | 68.124 | 7.661 |
| 10% Critical Value | 16.380 | 16.380 | 16.380 | 16.380 | 16.380 | 16.380 |
| N | 387 | 387 | 395 | 394 | 392 | 390 |

Notes: Notes: All columns present coefficient estimates and robust standard errors (in parentheses) from the following equations: $IBLI_{i,u,j} = \alpha^0 + \alpha^1 y_{i,u,j,t=0} + \alpha^2 x_{i,u,j,t=0} + \alpha^3 Discount_{i,u,j} + \gamma + \mu_{i,u,j}$, where $IBLI_{i,u,j} = 1$ if $IBLI_{i,u,j,t} > 0$, $Discount_{i,u,j} = 1$ if $Discount_{i,u,j,t} > 0$. * denotes significance at 0.10; ** at 0.05; and *** at 0.01. All columns include country and community fixed effects. In all columns, the reported 10% critical values are from Stock and Yogo (2005), which are the cutoffs that we compare effective F-statistics with to determine whether the instrument is weak.

Table E6: 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 | 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] | | | |
| Annual milk income (USD) (earnings and in-kind) | 540.99 | 0.00 | 21957.05 | 781 | 85.18 | 0.00 | 2125.04 | 398 | 387.12 | 0.00 | 21957.05 | 1179 |
| | [1361.23] | | | | [246.72] | | | | [1137.50] | | | |
| ***Exclusive categories*** | | | | | | | | | | | | |
| Annual total household income (USD) | 1293.43 | 0.00 | 22689.29 | 781 | 770.89 | 0.00 | 9333.62 | 398 | 1117.03 | 0.00 | 22689.29 | 1179 |
| | [1805.24] | | | | [904.29] | | | | [1579.41] | | | |
| Annual animal birth income (USD) | 159.93 | 0.00 | 7589.79 | 781 | 96.06 | 0.00 | 5292.39 | 398 | 138.37 | 0.00 | 7589.79 | 1179 |
| | [472.62] | | | | [365.90] | | | | [440.38] | | | |
| Annual employment (food for work) income (USD) | 1.32 | 0.00 | 147.96 | 781 | 5.33 | 0.00 | 649.64 | 398 | 2.67 | 0.00 | 649.64 | 1179 |
| | [8.36] | | | | [43.47] | | | | [26.21] | | | |
| Annual in-kind crop income (USD) | 12.40 | 0.00 | 995.77 | 781 | 17.08 | 0.00 | 962.43 | 398 | 13.98 | 0.00 | 995.77 | 1179 |
| | [68.85] | | | | [90.95] | | | | [77.01] | | | |
| Annual earnings from crop (USD) | 15.49 | 0.00 | 1972.76 | 781 | 18.45 | 0.00 | 750.69 | 398 | 16.49 | 0.00 | 1972.76 | 1179 |
| | [116.13] | | | | [72.96] | | | | [103.56] | | | |
| Annual in-kind milk income (USD) | 137.60 | 0.00 | 18970.03 | 781 | 79.02 | 0.00 | 2125.04 | 398 | 117.83 | 0.00 | 18970.03 | 1179 |
| | [1002.75] | | | | [233.12] | | | | [827.57] | | | |
| Annual sales from milk (USD) | 403.39 | 0.00 | 4154.44 | 781 | 6.16 | 0.00 | 309.90 | 398 | 269.30 | 0.00 | 4154.44 | 1179 |
| | [613.90] | | | | [35.70] | | | | [534.12] | | | |
| Annual in-kind slaughter income (USD) | 63.71 | 0.00 | 2367.31 | 781 | 2.93 | 0.00 | 254.45 | 398 | 43.19 | 0.00 | 2367.31 | 1179 |
| | [148.58] | | | | [19.76] | | | | [124.80] | | | |
| Annual earnings from slaughter (USD) | 10.22 | 0.00 | 1127.29 | 781 | 54.56 | 0.00 | 1539.88 | 398 | 25.19 | 0.00 | 1539.88 | 1179 |
| | [67.15] | | | | [199.41] | | | | [129.72] | | | |
| Annual earnings from the rest (USD) | 489.38 | 0.00 | 5636.45 | 781 | 491.30 | 0.00 | 2221.28 | 398 | 490.02 | 0.00 | 5636.45 | 1179 |
| | [664.12] | | | | [500.31] | | | | [613.51] | | | |
| 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 E7: 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 total household cash earning (USD) | 516.55 | 0.00 | 6877.83 | 781 | 462.92 | 0.00 | 5423.73 | 398 | 498.44 | 0.00 | 6877.83 | 1179 |
| | [828.25] | | | | [594.14] | | | | [757.52] | | | |
| Baseline annual milk income (USD) (earnings and in-kind) | 886.04 | 0.00 | 12192.44 | 781 | 161.81 | 0.00 | 2496.61 | 398 | 641.56 | 0.00 | 12192.44 | 1179 |
| | [1668.25] | | | | [265.31] | | | | [1408.50] | | | |
| ***Baseline exclusive categories*** | | | | | | | | | | | | |
| Baseline annual total household income (USD) | 1570.34 | 0.00 | 16205.37 | 781 | 770.81 | 4.52 | 9820.90 | 398 | 1300.44 | 0.00 | 16205.37 | 1179 |
| | [2038.94] | | | | [830.57] | | | | [1768.68] | | | |
| Baseline annual animal birth income (USD) | 130.64 | 0.00 | 2053.01 | 781 | 58.98 | 0.00 | 1107.34 | 398 | 106.45 | 0.00 | 2053.01 | 1179 |
| | [210.53] | | | | [103.70] | | | | [184.72] | | | |
| Baseline annual employment (food for work) income (USD) | 5.24 | 0.00 | 1120.88 | 781 | 50.67 | 0.00 | 424.86 | 398 | 20.58 | 0.00 | 1120.88 | 1179 |
| | [57.25] | | | | [82.32] | | | | [70.11] | | | |
| Baseline annual in-kind crop income (USD) | 0.00 | 0.00 | 0.00 | 781 | 0.00 | 0.00 | 0.00 | 398 | 0.00 | 0.00 | 0.00 | 1179 |
| | [0.00] | | | | [0.00] | | | | [0.00] | | | |
| Baseline annual earnings from crop (USD) | 14.41 | 0.00 | 2262.44 | 781 | 14.28 | 0.00 | 406.78 | 398 | 14.36 | 0.00 | 2262.44 | 1179 |
| | [138.19] | | | | [48.33] | | | | [115.90] | | | |
| Baseline annual in-kind milk income (USD) | 862.16 | 0.00 | 12192.44 | 781 | 155.10 | 0.00 | 2496.61 | 398 | 623.48 | 0.00 | 12192.44 | 1179 |
| | [1650.78] | | | | [261.07] | | | | [1392.56] | | | |
| Baseline annual sales from milk (USD) | 23.87 | 0.00 | 437.17 | 781 | 6.71 | 0.00 | 175.76 | 398 | 18.08 | 0.00 | 437.17 | 1179 |
| | [54.27] | | | | [28.00] | | | | [47.75] | | | |
| Baseline annual in-kind slaughter income (USD) | 31.88 | 0.00 | 840.34 | 781 | 36.44 | 0.00 | 793.22 | 398 | 33.42 | 0.00 | 840.34 | 1179 |
| | [56.82] | | | | [95.45] | | | | [72.20] | | | |
| Baseline annual earnings from slaughter (USD) | 5.14 | 0.00 | 2262.44 | 781 | 5.34 | 0.00 | 216.50 | 398 | 5.21 | 0.00 | 2262.44 | 1179 |
| | [82.39] | | | | [22.84] | | | | [68.34] | | | |
| Baseline annual earnings from the rest (USD) | 497.00 | 0.00 | 6877.83 | 781 | 443.31 | 0.00 | 5423.73 | 398 | 478.88 | 0.00 | 6877.83 | 1179 |
| | [814.35] | | | | [594.36] | | | | [747.54] | | | |
| 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.