Insuring Well-being? Buyer's Remorse and Peace of Mind Effects from Insurance

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Abstract

We estimate the causal effects of index insurance coverage on subjective well-being among livestock herders in southern Ethiopia. By exploiting the randomized distribution of discount coupons and information treatments to instrument for the purchase of index-based livestock insurance, and three rounds of panel data, we separately identify *ex ante* welfare gains from insurance that reduces risk exposure and *ex post* buyer's remorse effects that may arise after the resolution of uncertainty. We find that current insurance coverage generates subjective well-being gains that are significantly higher than the buyer's remorse effect of an insurance policy that lapsed without paying out. Given the positive correlation in insurance purchase propensity over time, failure to control for potential buyer's remorse effects can bias downward estimates of welfare gains from current insurance coverage.

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JEL codes: I31, I38, G22, O12, O13

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Uninsured risk exposure in low-income rural communities is widely believed to cause serious welfare losses and to distort behaviors, potentially even resulting in poverty traps (Rosenzweig and Binswanger 1993; Morduch 1994; Carter and Barrett 2006; Dercon and Christiaensen 2011; Barrett and Carter 2013; Santos and Barrett 2016). However, standard insurance products are routinely unavailable due to moral hazard and adverse selection problems and high transaction costs in infrastructure-poor areas (Besley 1995). In response to the lack of affordable standard insurance products, there has been a significant push to expand index insurance offerings in the developing world over the past decade.[1]

Index insurance attempts to mitigate adverse selection, moral hazard and high transaction cost concerns by writing contracts not on policyholders' realized losses but, instead, on a low-cost, observable indicator – the 'index' – believed to be strongly correlated with actual losses. There is, however, little empirical evidence that index insurance generates welfare gains for poor, rural households.[2] Indeed, the low uptake of index insurance products in a range of countries suggests that perhaps many prospective buyers believe index insurance does not deliver welfare gains (Giné et al. 2008; Binswanger-Mkhize 2012; Cole et al. 2013).[3] Index insurance uptake may even cause welfare losses

[1] See Chantarat et al. (2013) for an extensive discussion of these issues as they apply to a setting very similar to the one we study, and Miranda and Farrin (2012), Smith (2016) and Jensen and Barrett (2017) for broader reviews.

[2] Janzen and Carter (2018), Karlan et al. (2014), Jensen, Barrett, and Mude (2016, 2017) are notable recent exceptions.

[3] Giné, Townsend, and Vickery (2008) report that take-up rate of a rainfall insurance product in Andhra Pradesh, India was very low, at just 4.6 percent. They argue this might reflect the short history of the product. Similarly, Cole et al. (2013) find that the take-up rate of livestock insurance among the untreated general population in Andhra Pradesh and Gujarat, India, is close to zero. Binswanger-Mkhize (2012) argues that there is low demand for index insurance because better-off farmers have already self-insured through diversification of their portfolios and informal social networks, while the poor face liquidity constraints that limit their participation. Karlan et al. (2014), on the contrary, find that at an actuarially fair price,

for buyers for at least two reasons. First, high commercial loadings by insurers can drive premium rates far above actuarially fair levels. Second, when the index does not closely track policyholders' actual losses, the imperfect correlation creates "basis risk" that can result in uninsured losses despite the purchase of insurance. This can lead to uninsured catastrophic loss despite a premium payment; as a result, index insurance will not stochastically dominate remaining uninsured (Jensen, Barrett, and Mude 2016).

Estimating the welfare effects of insurance coverage is complicated because insurance produces two potentially opposite effects on the welfare of purchasers. Holding insurance before the resolution of uncertainty generates *ex ante* well-being effects. Insurance may increase *ex ante* welfare for risk averse agents prior to the realization of stochastic events that may otherwise impose substantial losses. These *ex ante* well-being effects of insurance may differ from, and be partly offset by, the *ex post* well-being effects of lapsed (i.e., expired) insurance that did not pay any indemnity. *Ex post* effects arise after the resolution of uncertainty. The same insurance that is *ex ante* welfare improving may prove *ex post* welfare reducing, in a later period, once the risk has passed, and the buyer realizes with perfect hindsight that she could have foregone the premium payment without consequence. In this case, the buyer has "lost" her premium and would have been unambiguously better off financially had she not bought insurance coverage after all. If insurance purchase is positively correlated over time, this then raises the possibility that buyer's remorse can confound valuation of insurance coverage, biasing downwards

almost half of the farmers in their sample from northern Ghana demand index insurance and purchase coverage for more than 60 percent of their acreage.

estimates of the value of current insurance coverage following periods without indemnity payments, when insurance purchase lost the insuree money.

In this article, we take a novel approach to estimating the welfare impact of insurance on a poor, rural population, exploring whether index insurance coverage improves subjective well-being (SWB) and disentangling the potentially distinct effects of current and lapsed insurance coverage. The analysis of gains from insurance coverage has typically relied on either relatively weak tests of stochastic dominance or strong assumptions about utility functions (Williams 1988; Feldman and Dowd 1991; Halek and Eisenhauer 2001; De Janvry et al. 2014). Recent innovations in SWB measurement, however, permit relaxation of many of the strong assumptions on which such analyses rely. Further, measures of SWB often yield deeper insights beyond the traditional income and expenditure based well-being measures (Ravallion 2014; Krueger and Stone 2014). Indeed, conventional measures of well-being may underestimate the true value of a program. A program can have significant effects on SWB even if it does not generate observable material or physical impacts (Devoto et al. 2012; Finkelstein et al. 2012; Ludwig et al. 2013). As a result, SWB measures have become increasingly popular in welfare assessment (Frey and Stutzer 2001; Clark 2003; Fafchamps and Shilpi 2008; Graham 2009; Ravallion et al. 2016; Kaminski 2014; Krueger and Stone 2014).

Several features of our data enable us to estimate the *ex ante* and *ex post* SWB effects of index insurance. First, the project's experimental design enables us to use an instrumental variables method to overcome potential selection issues in index-based livestock insurance (IBLI) uptake. We exploit the randomization of incentives (i.e., an encouragement design) to purchase IBLI, newly introduced in southern Ethiopia by a commercial underwriter in August 2012. We use these randomized incentives to instrument for IBLI uptake and estimate the local average treatment effect (LATE) of insurance on

SWB. The novelty of the product obviates the potential confounding of past, unobserved experience with IBLI on buyers' reported SWB.

Second, three-round panel data enable us to control for time-invariant household unobservable characteristics that might affect both SWB and IBLI uptake. Third, no indemnity payouts occurred during this period.[4] Without indemnity payments, we exploit the considerable intertemporal variation in households' IBLI uptake to isolate the causal effect of IBLI on SWB. We use coverage active during a survey round to capture *ex ante* welfare effects and coverage that had lapsed by the time of the survey to capture *ex post* impacts. These data offer an unprecedented opportunity to estimate the SWB effects of insurance that arise purely from *ex ante* risk reduction and to disentangle them from *ex post* buyer's remorse effects.

We find that current IBLI coverage improves SWB. Lapsed IBLI contracts that did not pay indemnities have a negative effect on SWB, consistent with the buyer's remorse hypothesis. Although both effects are statistically significant, the welfare gains of current coverage significantly exceed the adverse buyer's remorse effects. Our results are robust to a range of alternative estimators, corrections to address concerns on the measurement of SWB, variable definitions, model specifications and variations in the relevant panel sub-samples analyzed. Further, we show that the estimated SWB gains from insurance are downwardly biased if one does not control for lapsed insurance coverage that generates buyer's remorse.

The implication is that, despite premiums set above actuarially fair rates, IBLI improves buyers' SWB even over a period when pastoralists in southern Ethiopia lose money on the policy. The *ex ante* peace

[4] The first IBLI indemnity payments – on 509 contracts yielding total payments of ETB 526,000 (approximately $26,225) – occurred in October-November 2014, after the period covered by our data.

of mind effect – a positive subjective well-being effect resulting from resolution of anxiety over potential adverse shocks – dominates any *ex post* buyer's remorse – the regret that comes from initially having spent more on a good or service, subject to incomplete information, than one later wishes, once all information has been revealed. In other words, even an insurance policy that does not pay out still improves people's perceptions of their well-being.

Study Setting and Research Design

Our study area, Borana zone of Oromia region in southern Ethiopia, is a vast pastoralist land mass. It consists mainly of arid and semi-arid agro-ecological zones with a bimodal rainfall pattern and four distinct seasons: long rainy (March-May), long dry (June-September), short rainy (October-November), and short dry (December-February) seasons. Mobile pastoralism is the primary source of income and sustenance, with limited cereals cultivation for own consumption. Cyclical movement of livestock in search of forage and water characterizes the livestock production system in the zone (Coppock 1994; Berhanu 2011).

There are widespread concerns that more frequent droughts, perhaps associated with climate change, are making pastoralism more tenuous (Barrett and Santos 2014). Catastrophic droughts in the 1980s and 1990s resulted in herd losses of over 35% (Desta and Coppock 2002; Lybbert et al. 2004). These catastrophic droughts, which are covariate within a community, also put pressure on informal social insurance mechanisms, such as *iqub* (rotating savings and credit associations (ROSCAs)) membership. Informal community networks facing high and widespread herd losses can no longer sufficiently mitigate the effects of shocks and are in decline (Lybbert et al. 2004; Santos and Barrett 2011).

Formal insurance might effectively transfer drought risk out of the pastoral system to underwriters, thereby cushioning pastoralists against catastrophic herd loss shocks. However, conventional indemnity

insurance can be prohibitively costly to establish and sustain in this environment. Droughts that trigger payouts could bankrupt under-diversified insurers. Moral hazard and adverse selection problems and associated high monitoring costs, as well as high transaction costs in infrastructure-poor areas compound the challenges of delivering standard insurance products (Besley 1995).

IBLI was developed for precisely such an environment. Originally designed for and successfully piloted in the neighboring region of northern Kenya beginning in January 2010, IBLI makes indemnity payouts based on an observable, exogenous index of rangeland conditions, as reflected in Normalized Difference Vegetation Index (NDVI) measures generated by remote sensors on satellite platforms. An IBLI policy provides indemnity payouts when pasture vegetation falls below a contractually stipulated threshold level that reflects the onset of drought conditions that typically lead to excess livestock mortality (Chantarat et al. 2013).

IBLI was piloted in 2012 in eight *woreda*s[5] of Borana zone located directly across the border from the Kenyan region where IBLI first piloted. The index for IBLI Borana is calculated at the *woreda* level as a cumulative deviation of periodic NDVI readings for each IBLI sales period.[6] Accordingly, the IBLI premium rate differs across *woredas* and by livestock species but is the same for all buyers insuring the same livestock species within a *woreda*, irrespective of individual loss experience. The *woreda* specific

[5] *Woreda* is a third-level administrative division in Ethiopia, below region and zone. The eight *woredas* of Borana zone covered in our sample are Arero, Dhas, Dillo, Dire, Miyo, Moyale, Teltele and Yabello.

[6] For a more detailed discussion of the construction of the IBLI Borana index, see (ILRI-IBLI 2013). As described in the original IBLI design paper (Chantarat et al. 2013) and in the original study of demand for IBLI in southern Ethiopia (Takahashi et al. 2016), pastoralists seem to understand the concept of a measure of range vegetation biomass, although they surely don't comprehend the specific technology that generates the NDVI measure nor the index itself.

premium rates are applied to the value of herd that an IBLI buyer chooses to insure to establish the total amount that must paid for IBLI coverage.

IBLI contracts are sold in two sales periods prior to the start of the short and long rainy seasons. The first IBLI contracts were sold in August-September 2012 (sales period 1). Contract sales were repeated in January-February 2013 (sales period 2), August-September 2013 (sales period 3) and January-February 2014 (sales period 4). The duration of a contract's coverage is 12 months. The contract expires at the end of the 12-month coverage period, and is referred to as a lapsed contract once its contractual coverage period ends. Note that contract lapse is not a household choice; it is an exogenous artefact of the contract structure. A contract sold in January 2014 covers March 2014-February 2015, while one sold in August 2013 covers October 2013-September 2014. Households can augment their coverage by acquiring new contracts in subsequent sales periods. Index readings for each sales period are announced at the end the season. If the contractually stipulated strike rate is triggered, indemnity payments are made to policyholders (Figure 1).

Figure 1 here

As with all index insurance products, the substantial basis risk associated with IBLI could leave livestock loss uninsured due to imperfect correlation between the drought predicted by the index and losses experienced at the household level (Jensen et al. 2016). Animal losses due to covariate shocks that are not covered by IBLI, such as animal disease unrelated to rangeland conditions, as well as idiosyncratic shocks such as wildlife predation or injury, are common.

Nonetheless, recent impact evaluations of the original IBLI pilot in northern Kenya find income and productivity gains, on average, for IBLI policyholders (Jensen et al. 2017). But in that setting, significant indemnity payouts had occurred in the second year in which contracts were sold following

the catastrophic 2011 regional drought, so average indemnity payouts substantially exceeded average premium expenses. Those results could, therefore, be purely the result of stochastic ordering of loss events and associated indemnity payments. Those indemnity payouts had sizable behavioral and welfare effects (Janzen and Carter 2018). Because there were no indemnity payments in southern Ethiopia, our study isolates the welfare effects of insurance that arise purely from reduced *ex ante* risk exposure, that is, just the peace of mind effects that arise from buyers' risk aversion, abstracted from the complication of indemnity payments. The Ethiopia IBLI pilot and associated data enable us to get at these important issues in a novel way that sheds considerable light more generally on the value of insurance coverage.

Data and study design

A baseline survey (R1) was designed and fielded in February-March 2012 before IBLI was developed or announced. Data on a broad range of household characteristics, livestock and other assets, livelihood activities, consumption, social networks, expectations and subjective well-being were collected. A year later, following sales period 2, a follow-up survey round (R2) of the original sample households was fielded in March-April 2013. Following sales period 4, a third round (R3) of survey data was then conducted in March 2014 from the same respondents as the first two survey rounds. We therefore have pre-experiment baseline data (R1), followed by two survey rounds (R2 and R3) with the same respondents. In R2, IBLI contracts purchased in sales periods 1 and 2 were in force. In R3 contracts from sales periods 1 and 2 had lapsed but contracts purchased in sales periods 3 and 4 were in force (Figure 2).

Figure 2 here

Sampling was clustered at the *reera* level.[7] *Reera*s were purposively selected based on geographic distribution, variation in market access, and agro-ecological variation across the eight *woreda*s of Borana *zone* in our sample. Inaccessible *reera*s were excluded for logistical reasons. In each *reera*, households were grouped into three livestock holding classes (high, medium and low) measured in tropical livestock units (TLU).[8] Fifteen percent of households were randomly selected in each *reera* such that a minimum of 25 households were selected with a balanced representation of the three TLU classes (terciles). In the event 15 percent of households in a *reera* yields less than 25 households, neighboring *reera*s were combined to form a bigger study site, resulting in a total of 17 study sites (ILRI 2014).

The baseline sample included 515 households. In R2, 476 of the original (baseline) households were re-interviewed. Households that had dropped out were replaced by households from the same study site and TLU class. If replacements could not be found in the same TLU class, households in the adjacent TLU class were picked. Thus, 32 new replacement households were surveyed from the original population lists for a total of 508 households in R2. In R3, 500 R2 households and 14 replacement households were surveyed. In selecting replacements in R3 priority was given to original households (sampled in R1 but missed in R2). Of the 14 R3 replacements, 10 were households surveyed in R1 but not R2 and 4 were new households.

Seven households had missing SWB measures or key independent variables and were dropped from the sample. The final estimation sample includes 550 unique households and 1,530 observations (515

[7] *Reera* is the fourth level administrative division in Oromia region below zone, *woreda*, and *kebele*.

[8] TLU is a measure used to aggregate livestock across species in relation to a common average metabolic weight such that 1 TLU = 1 cattle = 0.7 camels = 10 goats or sheep, collectively called 'shoats'.

in R1, 504 in R2 and 511 in R3), of which 465 households were surveyed in all three rounds, 50 households were surveyed in two rounds (8 in R1 and R2, 12 in R1 and R3, and 30 in R2 and R3), and 35 households were surveyed only once. A detailed treatment of potential attrition bias in the data is presented in the supplementary appendix online (Tafere et al. 2018).

To encourage IBLI uptake, various combinations of premium discount coupons and information interventions through audio tapes or comic books were randomly implemented in each IBLI sales period (Table 1). Prior to each sales period, all communities received a basic briefing on the IBLI product. The information treatments were delivered via caricature representation of IBLI in comic books or audio tapes of a poem about IBLI recited in the local language, Oromifa.[9] The two information treatments – comic book and audio tape – were randomized at the village level in six sites each, with no overlap in assignment. First, 12 of the 17 study sites were selected to receive information treatment, with six sites assigned to comic book and the other six sites assigned to audio book treatment arms. Within each site selected for information treatment, half of the respondents were randomly selected for treatment. The randomized assignment of respondents into information treatments was implemented independently for each sales period. The encouragement design in sales periods 3 and 4 did not include information interventions.

[9] In the comic book information treatment, a randomly selected sub-sample of respondents was provided with a caricature representation of the IBLI product prepared by the underwriter, Oromia Insurance Company (OIC). The contents of the material were first read to the sample households, then they were encouraged to look/read through it as many times as they wished. In the audio tape information treatment, development agents (DAs) were asked to play a tape that explains IBLI in Oromifa to a randomly selected sub-sample of respondents (for more details on the information interventions see ILRI 2014).

The discount coupon treatment was implemented at the household level. In each study site, 80 percent of respondents were randomly selected to receive discount coupons that would allow them to purchase IBLI at a discounted price for up to 15 TLUs. Discount coupon recipients were evenly distributed across discount levels of 10, 20, 30, 40, 50, 60, 70, and 80 percent. The remaining 20 percent of respondents did not receive discount coupons.[10] All four sales periods included newly randomized distribution of premium discount coupons, with each non-transferrable coupon uniquely assigned to a specific survey respondent. A detailed documentation of the encouragement design for each IBLI sales period is provided in Appendix Table A1. By creating exogenous variation in IBLI uptake and in the effective premium faced by prospective buyers, IBLI's randomized encouragement design allows a rigorous analysis of the causal impacts of IBLI on SWB.[11]

All sample households in our study sites had opportunities to insure against drought-related livestock loss. Yet, only 22 percent and 21 percent of households surveyed in R2 and R3, respectively, reported buying IBLI coverage. In both R2 and R3, IBLI purchases were lower in the January-February sales period than in the August-September sales period. Of the 504 households surveyed in R2, 130 purchased IBLI in sales period 1 and 94 in sales period 2. Similarly, of the 514 households surveyed in R3, 150 purchased IBLI in sales period 3, but only 62 in sales period 4. This difference might arise due

[10] As part of a separate project, 10 respondents received IBLI coverage for up to 15 TLUs free of charge (100% discount) in each sales period. These respondents are not included in our analysis.

[11] The same experimental design also enabled identification of the determinants of demand for IBLI (Takahashi et al. 2016), exploration of potential gender-based differences in IBLI uptake (Bageant and Barrett 2017), and of the impact of IBLI on informal insurance arrangements in southern Ethiopia (Takahashi et al. in press). This is the only article that exploits the subjective well-being variables collected precisely for the purpose of testing the hypotheses at the heart of this article.

to seasonality in household liquidity.[12] Or this may simply reflect the seasonality arising due to the initial launch of IBLI in August-September 2012, combined with the contracts' 12 months duration.

Because IBLI contracts cover a full year but policies are sold in two sales periods each year, households can augment their coverage or allow contracts to lapse. Of the 130 IBLI buyers in sales period 1, 23 buyers augmented coverage further by buying additional policies in sales period 2, 53 allowed their policy to lapse after a year, and 77 extended their coverage in sales period 3. The remaining 71 buyers in sales period 2 were first time buyers. Likewise, 73 of the 94 IBLI buyers in sales period 2 allowed their contracts to lapse and 21 renewed their contract in sales period 4. Among the 150 households who bought IBLI policies in sales period 3, 33 households bought additional coverage in sales period 4. Annual premiums and out of pocket payments are presented in Appendix Table A2. The considerable intertemporal variation in households' IBLI coverage, combined with the experimental design behind the IBLI pilot, enable us to disentangle the causal effects of current and lapsed insurance policies on respondents' SWB.

Summary statistics

Table 1 reports baseline treatment-control covariate balance tests on assignment to premium discount coupon in sales periods 1 and 2. There is very little pre-treatment difference in subjective well-being, wealth, expected livestock loss, various household characteristics, and group membership between those who purchased insurance and those who did not, confirming that the randomization was

[12] Extended dry conditions often lead to stress sales and collapse of livestock markets, which in turn limits ability to raise the necessary liquidity to insure against shocks (Barrett et al. 2003; Lybbert et al. 2004).

successful.[13] Detailed variable definitions are provided in Appendix Table A3. To complement these results, we also conducted formal joint orthogonality tests and found that selection into treatment is uncorrelated with observable household characteristics (Appendix Table A4). Joint significance tests from pooled OLS (linear probability model) regression of treatment dummies (discount coupon, audio tape and comic book) for the August-September and January-February sales periods on household income, livestock and non-livestock assets, expectations of future rangeland conditions, and various individual and household characteristics suggest that treatments are randomly assigned. We cannot reject the joint null of zero partial correlation of all covariates in these regressions. Apart from the discount coupon regression in the August-September sales period, pre-treatment differences in covariates between treatment and control households are statistically insignificant in almost all cases.

Table 1 here

Table 2 reports summary statistics on key dependent and independent variables by insurance status.[14] The top four rows show that households who had IBLI coverage in R2 and/or R3 report higher SWB – by any of the four different measures discussed in the next section – compared to their counterparts who have had no IBLI coverage in any of the survey rounds. Rows 5-9 show that IBLI purchase is strongly positively correlated with the discount coupon and information treatments. In each sales period, about 93 percent of IBLI contract holders had received discount coupons.[15] Similarly,

[13] Covariate balance tests on comic book and poet audio tape information treatments and discount coupon receipts in sales periods 3 and 4 also show that treatment assignment was indeed random. Findings are available upon request.

[14] Table 2 presents the averages of the variables in R2 and R3, during which IBLI was available for purchase.

[15] Since survey rounds 2 and 3 were preceded by two sales periods each, a household who purchased IBLI in sales period 2 but had received discount coupon in sales period 1 is reported to have received discount coupon for the survey round, hence the slightly higher figures in Table 2.

households who received information treatments (comic book or audio tape) were more likely to buy IBLI. As expected, higher discount rates are strongly correlated with IBLI uptake. These simple descriptive statistics suggest that the random, exogenous assignment of discount coupons and information treatments are suitable predictors of IBLI adoption.

Table 2 here

Insured and uninsured households are not distinguishable by observable characteristics, apart from number of TLU owned, which is weakly statistically significant. The value of non-livestock assets, annual income, expected livestock loss, gender and age of household head, household size and composition, and membership in *iqub* groups vary insignificantly between those that purchased insurance and those who did not. These findings on observable characteristics do not rule out potential differences based on unobservable characteristics. However, so long as such unobservable differences are time invariant, we can control for them using a fixed effects estimator. Concerns that time varying characteristics may determine IBLI adoption nonetheless remain. We exploit the random assignment of discount coupon and information treatments, each strongly correlated with IBLI uptake, to address these concerns.

Estimation strategy

A key challenge in evaluating policy interventions where respondents can voluntarily "opt-in" is that selection into the program may not be random. Rather, participation could be systematically correlated with respondents' observable and unobservable characteristics. Peoples' SWB is likely correlated with their subjective assessment of risk, their planning horizons, and other unobserved factors that influence insurance uptake. The experimental design features of IBLI's impact evaluation, including randomized exposure to various information treatments and randomized distribution of premium discount coupons,

allow us to address the selection bias associated with insurance uptake choices. Note, however, that the randomized treatments offer inducements to purchase IBLI – i.e., they constitute an encouragement design – rather than directly provide insurance coverage.

We first estimate selection into IBLI using randomized encouragement treatments as instruments. We then estimate the effect of instrumented IBLI on SWB. This approach allows us to derive unbiased and consistent causal estimates of IBLI's impact on SWB.

IBLI uptake by household *i* in village *v*, sales period *s* and survey round *t*, is estimated using the linear probability model (LPM)[16] as:

$$(1) \qquad Pr(IBLI_{ivt} = 1) = \omega + \gamma_s D_{ivst} + \phi_s A_{ivst} + \mu_s C_{ivst} + \eta_s P_{ivst} + \zeta X_{ivt} + \kappa_t + \tau_i + \epsilon_{ivt}$$

The randomly assigned treatments include dummy variables for receiving a randomly assigned premium discount coupon (*D*) in the first sales period (August-September 2012), the second sales period (January-February 2013), or both; dummy variables for receiving randomly assigned extension treatments in either audio tape (*A*) or comic book (*C*) form in the first, the second or both sales periods, and a *woreda* specific continuous measure of the randomly discounted IBLI premium rate (*P*) in the first and second sales periods. These are all randomly assigned to households and should have no direct effect on SWB, only an indirect effect through their impact on inducing IBLI uptake. The lone possible exception is *P*, since price variation has a (very modest) real income effect conditional on someone purchasing IBLI and thus could plausibly have some direct effect on SWB. A series of covariates, *X*,

[16] To avoid the "forbidden regression" problem associated with non-linear models such as logit or probit, we use an LPM to predict an endogenous dichotomous variable in the first stage of an instrumental variables (IV) regression (Angrist and Pischke 2008; Wooldridge 2010).

that may influence the uptake of IBLI are included as controls, including household herd size and income, expectation of livestock death, gender, age and educational attainment of household head, and household composition. Household fixed effects (FE), τ, which control for, among other things, time invariant optimism or pessimism of individual respondents and survey round fixed effects, κ, are also included.

We use the randomized coupon distribution and information treatments to instrument for the purchase of IBLI coverage in the first stage estimation. When applied to R2 data, equation (2) predicts current uptake, $\widehat{IBLI_{iv2}}$, based on purchases in sales periods 1 and 2. There were no lapsed contracts in R2. When applied to R3 data, it predicts current uptake, $\widehat{IBLI_{iv3}}$, based on purchases in sales periods 3 and 4. We use the $\widehat{IBLI_{iv2}}$ predicted value to capture lapsed contracts in R3. That is, we regress a dummy variable of having bought IBLI in the previous round on randomized assignment to discount coupon and information treatments in the previous round.

Though IBLI is available for purchase to all households in our study area, the encouragement design was designed to generate greater uptake of IBLI in the treatment group than in the control group. If the assumptions of treatment exogeneity and compliance monotonicity are satisfied, difference in uptake between the treatment and control groups can be used to estimate the local average treatment effect (LATE) of IBLI on SWB (Imbens and Angrist 1994; Angrist, Imbens and Rubin 1996). Given that treatment assignment is randomized, the instruments are clearly exogenous to SWB. Compliance monotonicity requires that if a household purchases IBLI without treatment it should also purchase IBLI with treatment, and if a household does not purchase IBLI with treatment it should not buy IBLI without treatment. Treatment defiance (i.e., violation of the compliance monotonicity assumption) is not a concern in our data. In informal discussions and in midline focus group discussions with subjects, we repeatedly heard statements reinforcing adherence to compliance monotonicity. Thus, the

coefficient estimates on predicted IBLI uptake in the second stage regressions give unbiased causal estimates.

We estimate the LATE of IBLI on SWB, rather than the intent to treat (ITT) effect of the randomized incentives directly, for multiple reasons. First, ITT estimates do not distinguish between non-compliance and lack of program impact. Since compliance with an encouragement design is not of particular policy interest, the ITT effect of discount coupons or extension messaging is not of intrinsic interest. Rather, the question of policy interest is purely the (LATE) impact of insurance. Second, the field experiment was designed, given limited budget, to elicit the LATE and would be significantly underpowered to identify ITT effects, given the expected (and confirmed) effects of covariates such as educational attainment and herd size on compliance (Jo 2002; Takahashi et al. 2016). In our study, on average only about 20 percent of households assigned to discount coupon purchase IBLI in each sales period. In this setting LATE is more appropriate than ITT.[17]

In the second stage of our estimation, the predicted IBLI coverage is used to estimate the causal effect of IBLI on SWB. SWB includes ordinal responses to the question "*on which step do you place your current economic condition*," ranging from 1 (very bad) to 5 (very good). The construction of our SWB measure and related robustness checks are discussed in more detail below. The second stage ordered logit regression includes predicted IBLI uptake, number of TLUs owned (TLUO), predicted lapsed IBLI uptake – the probability of having acquired an IBLI contract that has lapsed (IBLIL), a series of controls, X, household fixed, σ , and survey round fixed effect λ.

[17] ITT estimates are consistent with our core LATE findings, with positive estimated effects, but only a few individual estimates are statistically significant, consistent with the underpowered design for an ITT study. Results are available by request.

$$(2) \qquad SWB_{ivt} = \alpha + \beta\, \widehat{IBLI}_{ivt} + \theta\, TLUO_{ivt} + \pi\, \widehat{IBLIL}_{ivt} + \delta X_{ivt} + \lambda_t + \sigma_i + \varepsilon_{ivt}$$

The coefficient estimate on predicted IBLI uptake, $\hat{\beta}$, measures the effect of IBLI coverage on the extensive margin – the ordered log-odds estimate of possessing IBLI contract(s) on SWB. We expect that effect to be positive, reflecting the welfare gains from insurance in a risky setting. The coefficient estimate on $\widehat{IBLIL}_{ivt}$, $\hat{\pi}$, measures the effect on SWB of an IBLI contract that was in force in R2 but had lapsed in R3. Since contracts in force are controlled for, this coefficient estimate isolates the *ex post* SWB effect of insurance that did not pay, i.e., buyer's remorse, and it is expected to be negative ($\hat{\pi} < 0$).

A finding that $\hat{\beta} > |\hat{\pi}|$ indicates that even if insurance does not pay out, in expectation, the positive peace of mind effect exceeds the negative buyer's remorse effect, and hence IBLI improves expected welfare. If policy purchases – and therefore current and lapsed policies – are correlated over time, failure to include lapsed contracts in equation (2) would lead to omitted relevant variable bias of the β estimate, presumably downwards due to negative buyer's remorse effects.

To capture the intensive margin of IBLI coverage, i.e., the marginal effect of increasing the volume of IBLI uptake by a unit, we re-estimate equation (1) replacing the IBLI uptake dummy variable with volume of TLUs insured (TLUI). The first stage equation for the negative censored continuous variable *TLUI* is estimated using Tobit as:

$$(3) \qquad TLUI_{ivt} = \tilde{\omega} + \tilde{\gamma}_s D_{ivst} + \tilde{\phi}_s A_{ivst} + \tilde{\mu}_s C_{ivst} + \tilde{\eta}_s P_{ivst} + \tilde{\zeta} + \tilde{\kappa}_t + \tilde{\tau}_i + \tilde{\epsilon}_{ivt}.$$

The choice of Tobit to model TLUs insured is informed by the censored, non-negative nature of the variable. While the broad class of non-linear models suffer from an incidental parameters problem in

fixed effects estimation, the Tobit model does not suffer this problem. The slope coefficient estimates of the Tobit fixed effects model – the parameters of interest in this study – are unbiased and consistent (Greene 2004).

We construct predicted values for current and lapsed IBLI coverage using the same approach as we did for the discrete uptake variable earlier. The second stage ordered logit regression then includes predicted TLU insured and predicted lapsed TLU insured instead of predicted IBLI uptake to identify the causal effect of buying an additional TLU of IBLI coverage on SWB.

$$(4) \qquad SWB_{ivt} = \tilde{\alpha} + \tilde{\beta}\widehat{TLUI}_{ivt} + \tilde{\theta}TLUO_{ivt} + \tilde{\pi}\widehat{TLUL}_{ivt} + \tilde{\delta} + \tilde{\lambda}_t + \tilde{\sigma}_i + \varepsilon_{ivt}$$

The second stage regression equations of both IBLI uptake (equation 2) and volume of TLU insured (equation 4) include generated regressors. Conventional standard errors of the estimated coefficients would be biased downwards. To account for the lower variation in the predicted uptake and volume of TLUs insured, we estimate the standard errors using a bootstrapping method where both the first and second stage are included for every bootstrap sample. Further, to account for spatial correlation of observations estimated standard errors are clustered at the village (*reera*) level in all regressions.

Equations (1) - (4) are estimated using the full sample of 465 households observed in all three rounds, 50 households observed in two rounds and 35 households observed in a single round. If attrition is not systematic, the standard unbalanced panel data approach produces unbiased and consistent estimates. Much of the attrition in our data arises because of inaccessibility of some households due to the main rainfall season during the survey periods. Nevertheless, we address potential systematic attrition in our data in two ways. First, we re-estimate our first and second stage regressions for the balanced panel

only to establish the robustness of our core results. Second, we conduct a formal test of attrition bias (see the online appendix).

There are at least two possible mechanisms through which IBLI coverage could influence SWB. The first effect is the gross nonmonetary benefits or costs associated with coverage, represented by the coefficient estimate on the instrumented IBLI, $\hat{\beta}$, net of instrumented lapsed IBLI, $\hat{\pi}$, $(\hat{\beta} + \hat{\pi})$, or the coefficient estimate on instrumented TLU insured, $\hat{\hat{\beta}}$, multiplied by the number of TLUs insured net of the coefficient on instrumented lapsed TLU insured, $\hat{\hat{\pi}}$, multiplied by the number of lapsed TLUs insured, $(\hat{\hat{\beta}} \times \widehat{TLUI}_t + \hat{\hat{\pi}} \times \widehat{TLUL}_t)$. Purchasing insurance may reduce stress about possible adverse outcomes, which could lead to higher levels of SWB ($\hat{\beta} > 0$), while greater coverage may lead to higher SWB ($\hat{\hat{\beta}} > 0$). Conversely, if the basis risk on the product is high such that IBLI payout is more like a lottery ticket than a conventional indemnity insurance policy, IBLI uptake could increase stress and reduce SWB ($\hat{\beta} < 0$). For the same reason, greater IBLI coverage may cause higher stress and lower SWB ($\hat{\hat{\beta}} < 0$).

The second influence on SWB arises from the net monetary benefit or cost of IBLI coverage on SWB. If net income or wealth influences SWB, as many studies suggest (Frey and Stutzer 2010; Graham 2012), then IBLI will also affect SWB through the premium amount paid for IBLI, which reduces net income or wealth, and any indemnity payment received in the event that the IBLI policy pays out, which increases net income or wealth, *ceteris paribus*. This effect is captured by the coefficient estimate on the number of TLUs owned, $\hat{\hat{\theta}}$, multiplied by the net flow of funds associated with the period-

specific net indemnity payments (indemnity receipts minus premium payments) associated with the predicted IBLI uptake volume, converted into TLU units at prevailing livestock prices, *NI*.[18]

We therefore estimate the aggregate effect of IBLI on SWB as:

$$\Delta\widehat{SWB}_{ivt} = \frac{\hat{\hat{\beta}}}{s} \times \widehat{TLUI}_{ivt} + \frac{\hat{\hat{\pi}}}{s} \times \widehat{TLUL}_{ivt} + \frac{\hat{\hat{\theta}}}{s} \times NI_{ivt} \quad (5)$$

The point estimate $\hat{\hat{\beta}}$ from equation (5) reflects the SWB benefit of a unit of free IBLI with no indemnity payment. Likewise, the coefficient estimate $\hat{\hat{\pi}}$ measures the SWB loss due to a unit of free IBLI that has expired without payout. Note, however, that $\hat{\hat{\beta}}$, $\hat{\hat{\pi}}$ and $\hat{\hat{\theta}}$ measure effects on SWB in log-odds scales while SWB is measured in ordinal Likert scale. It is necessary to harmonize the units in which these coefficients and SWB are measured before one can calculate the overall effect of IBLI on SWB. We use the fact that the logistic and Normal distributions are similar, except at the tails of the distribution, to convert the coefficients from log-odds units to Normal equivalent deviates. The effects measured in log-odds and their corresponding standard errors can be converted to approximate effects in Normal equivalent deviates by dividing by the standard deviation of the logistic distribution $s = \pi/\sqrt{3}$ (Hasselblad and Hedges 1995, Chinn 2000).

Given that during R2 and R3 there were no indemnity payments but respondents paid for IBLI, our estimates provide a lower bound, reflecting the SWB associated with insurance coverage in the absence of any payout, i.e., a period in which insurance represents an unambiguous financial loss. A finding

[18] $NI = \frac{(Indemnity\ per\ TLU - Premium\ per\ TLU)}{Price\ per\ TLU} \times \widehat{TLUI}$ is the TLU equivalent wealth gained or lost due to IBLI purchase.

that $\Delta\widehat{SWB}_{ivt} > 0 | NI_{ivt} < 0$ would therefore represent a strong finding with respect to the welfare effects of index insurance in this setting.[19]

SWB and vignette correction

Subjective measures of welfare are becoming increasingly popular but pose methodological challenges (Krueger and Schkade 2008; Ravallion 2014). Respondents may have different reference points when answering a subjective question, making interpersonal comparisons problematic. To address any latent heterogeneity problems that might hinder interpersonal comparisons of subjective welfare, we adjust the subjective measures of well-being using hypothetical vignettes that provide an explicitly standardized reference point for respondents in order to bring objective and subjective assessments into alignment (van Soest et al. 2011; Krueger and Stone 2014).[20]

Interpersonal comparisons using SWB data can be challenging due to potential unobserved heterogeneity in respondents' reference points, which may depend on socio-economic conditions, and other observable and unobservable characteristics. Such latent heterogeneity in subjective well-being measures may render interpersonal comparisons meaningless and invalidate inference from subjective welfare regressions (King et al. 2004; van Soest et al. 2011; Beegle et al. 2012; Ravallion et al. 2016).

[19] Estimates for $\Delta\widehat{SWB}$ are obtained by evaluating (6) at the average TLUs insured and NI. The price per TLU is obtained by weighting livestock prices from *Haro Bake* livestock market (the largest livestock market in Borana zone) with the TLU conversion units of each species (see Appendix Table A3).

[20] As discussed further below, we test the robustness of our core results by re-estimating our model for direct (unadjusted) SWB responses and for responses to a similar SWB question that asks people about their well-being relative to other Borana pastoralists. The core findings prove stable.

An increasingly popular approach for correcting latent heterogeneity problems involves measuring the interpersonal incomparability of responses itself (King et al. 2004; King and Wand 2007); van Soest et al. 2011; Beegle et al. 2012). Respondents are asked to assess their own circumstances relative to a set of hypothetical individuals described by short vignettes on the same scale. Responses to the hypothetical vignettes are then used to construct an interpersonally comparable welfare measure as respondents' reference points have been exogenously standardized. The validity of this approach relies on two key assumptions: response consistency, and vignette equivalence. Response consistency requires that each respondent use response categories for a particular concept in the same way when self-assessing as when assessing hypothetical individuals. Vignette equivalence is the assumption that each respondent perceives the level of the variable represented by a particular vignette on the same unidimensional scale. That is, the variable being measured by vignettes should have a consistent meaning among respondents (King et al. 2004).

Following King et al. (2004), the reported SWB measures are corrected using a simple non-parametric approach. For notational ease, we momentarily suppress the village and time dimensions of the data. Suppose SWB_i is the categorical self-assessment for respondent i (i=1,…, n), and V_{ij} is the categorical survey response for respondent i on vignette j (j=1,.., J). For respondents with identical vignette ordering (i.e. $V_{i,j-1} < V_{ij}$) the vignette adjusted measure of subjective well-being is given as:[21]

[21] In our data, rescaling of self-assessments relative to vignettes does not generate vector responses, which are associated with inconsistent vignette ordering or correspondence of self-assessment with more than one vignette responses. As a result, the standard class of econometric methods for ordered dependent variables is suitable for our analysis.

$$(6) \qquad VSWB_i = \begin{cases} 1 & \text{if } SWB_i < V_{i1} \\ 2 & \text{if } SWB_i = V_{i1} \\ 3 & \text{if } V_{i1} < SWB_i < V_{i2} \\ . & . \\ . & . \\ 2J+1 & \text{if } SWB_i > V_{iJ}. \end{cases}$$

The hypothetical vignettes used in this study involve households that fall in one of three well-being rungs: low, middle and high, which were constructed in consultation with local field researchers knowledgeable about the local socio-economic conditions in the study area. The lowest (poor), middle, and highest (rich) rungs were represented by a family that "*has no livestock and does not eat meat except on special occasions*," a family that "*has a dozen of shoats* [goat and sheep]*, but no camel or cattle and can eat meat only once a month*," and a family that "*has a lot of shoats and several camels and cattle and can eat meat whenever they choose*", respectively.

The cross tabulation of SWB measures and vignette corrected SWB measures in Appendix Table A5 shows that vignette corrected SWB measures largely mirror SWB, particularly at the lower end of the scale. For example, in panel (a), out of the 120 observations with SWB score of one (very bad), 27 are rescaled to one and 93 to two on the vignette adjusted SWB. Similarly, of the 88 observations with SWB scores of five (very good), none is rescaled one, and only five to two on the vignette adjusted SWB. We observe similar correspondence between SWB relative to Borana pastoralists and its vignette corrected equivalence in panel (b).

To test the robustness of our results to potentially unstable responses, we re-estimate the model using alternative SWB measures – vignette corrected SWB relative to Borana pastoralists and SWB relative to Borana pastoralists. The SWB relative to Borana pastoralists variable is similar to the SWB measure, but respondents are asked to gauge their life relative to other Borana pastoralists. The anchoring of

subjective well-being questions reduces the likelihood that respondents may have different reference groups in mind when responding (Ravallion 2014).

Results

We first discuss the estimated vignette-corrected SWB effects of IBLI on the extensive margin, followed by discussion of results on the intensive margin.[22] Table 3 presents the first stage panel fixed effects LPM estimates of equation (2) (columns 1-2) and panel random-effects (RE) Tobit model of equation (3) (columns 3-4). Column 1 shows results from a basic model with just randomized discount coupon and audio tape and comic book information extension treatments in sales periods 1 and 2. In column 2, in addition to the randomized discount coupon and information treatments in column 1, we include a broad range of household characteristics, wealth measures, IBLI knowledge, expectations of livestock loss, membership in *iqub* ROSCAs, and survey round fixed effects. The parameter estimates of both models show that randomized treatments had positive effects on IBLI uptake and, thus, can serve as suitable instruments. Receiving a discount coupon and the amount of the discount were especially strong predictors of IBLI uptake. Receiving a discount coupon in sales period 1 increases the probability of buying IBLI policy by over 20 percent. This effect is even greater for the discount coupon in sales period 2 – it increases the odds of buying IBLI by about 24 percent. Moreover, having received discount coupons in sales period 1 increases the probability of buying coverage for recipients of discount coupons in sales period 2. Besides the price effect of discount coupons, which is captured

[22] Previous studies find positive effects of IBLI on income and other outcome variables in neighboring Northern Kenya (Jensen, Barrett and Mude 2017; Janzen and Carter 2018). In our study area, preliminary results show that IBLI is positively but statistically significantly correlated with household incomes (Appendix Table A6). This is consistent with findings from the studies in northern Kenya that report positive income and productivity gains in a setting where IBLI has already triggered indemnity payments, unlike in southern Ethiopia.

by the coefficient estimates on discount values, the discount coupon had informational value, offering holders a physical reminder of the insurance product. Conditional on the amount of discount received and other covariates, receiving a discount coupon had an independent positive effect on IBLI uptake.

Table 3 here

Randomized provision of audio tape and comic book information treatments also had a positive, albeit weaker, effect on IBLI uptake. The audio tape treatment had a positive and statistically significant effect in sales period 2. The comic book treatment, however, had an effect on IBLI uptake only when offered in both sales periods, suggesting the effectiveness of repeated exposure to this informational approach. Both Sargan ($\chi^2(24) = 75.36,\ prob > \chi^2 = 0.000$) and Basmann ($\chi^2(24) = 79.17,\ prob > \chi^2 = 0.000$) over-identification tests fail to reject the null hypothesis that our instruments are valid. The Wald test for joint significance of all instruments also strongly rejects the null of jointly insignificant instruments ($\chi^2(24) = 137.8,\ prob > \chi^2 = 0.000$). Thus, this first stage appears to successfully instrument for endogenous IBLI uptake.

IBLI uptake relates to our control variables in the expected ways. Uptake is positively correlated with knowledge about IBLI and wealth (livestock and non-livestock assets), but only number of TLUs owned is statistically significant. Income and *iqub* membership are negatively but statistically insignificantly correlated with IBLI uptake. The later suggests that *iqub* may crowd out IBLI. We also find that male headed households are less likely to buy IBLI and that larger household are more likely to buy IBLI.[23]

[23] As a robustness check, we also estimate a probit selection model. The results are strongly consistent with the LPM (Appendix Table A7).

We find similar results when estimating a Tobit model for volume of TLUs insured to study IBLI uptake at the intensive margin (columns 3-4, Table 3). Receiving discount coupons and the size of the discount carried by the coupon are strong predictors of the volume of TLUs insured. The audio and comic book information treatments were also found to be positively, but relatively weakly, related to the volume of IBLI coverage. The number of TLUs owned is positively related to volume of coverage. In line with the IBLI uptake results in columns 1 and 2, we find that IBLI knowledge influences the volume of uptake. Respondents with more correct answers to questions about the particulars of the IBLI contract are more likely to buy IBLI, a result consistent with ambiguity aversion (Bryan 2018). *Iqub* membership reduces the volume of TLUs insured, as such traditional institutions lower the demand for other forms of insurance.

Table 4 reports second stage ordered logit regression results of the effects of IBLI on vignette corrected SWB. Panel (a) shows the effects of IBLI in log-odds units. While these results are concise and more convenient for presentation purposes, their interpretation may not be straight forward. In panel (b), we present the corresponding marginal effects of the main results in panel (a). Columns 1-3 show the extensive margin effects of IBLI uptake on SWB. Since randomized discount coupon and information treatments were used as instruments for the potentially endogenous IBLI uptake in stage one, the coefficient on $\widehat{IBLI}$ measures the causal effect of IBLI on SWB. We find that IBLI has a strong positive effect on SWB, presumably because insurance coverage reduces risk exposure for risk averse buyers. The full model in column 3 shows that IBLI uptake increases the log-odds of reporting higher SWB by 0.86. That is, IBLI buyers are 2.4 ($\approx e^{0.86}$) times more likely to report higher SWB than lower SWB. The probability estimates in panel (b) make this point clearer. IBLI reduces the probability of reporting lower SWB ($SWB \leq 3$) by 11 percent and increases the probability of reporting higher SWB ($SWB \geq$

5) by 11 percent. Our results are robust to the inclusion of income, wealth, a range of demographic and household characteristics, and household composition variables.[24]

Table 4 here

At the time of the R3 survey implementation, IBLI policies from sales period 1 and sales period 2 had already lapsed without payout. Thus, the coefficient estimate on $\widehat{IBLIL}$ captures the negative *ex post* SWB effect of having bought an insurance policy that did not pay out. Indeed, the negative and statistically significant coefficient estimate on $\widehat{IBLIL}$ indicates buyer's remorse. Having bought an IBLI contract that lapsed without pay out reduces the log-odds of reporting high SWB by 0.44, which indicates that buyers of lapsed IBLI contracts are 1.5 ($\approx 1/e^{-0.44}$) times more likely to report lower SWB than higher SWB. In probability units, having bought a lapsed IBLI contract increases the probability of reporting low SWB ($SWB \leq 3$) by 5 percent and decreases the probability of reporting high SWB ($SWB \geq 5$) by 5 percent. More importantly, the magnitude of the $\widehat{IBLIL}$ coefficient is statistically significantly smaller than that of $\widehat{IBLI}$. This suggests that people are comforted by insurance coverage, and the positive *ex ante* effect trumps the negative *ex post* regret they feel once they realize that they paid for insurance that, in retrospect, they did not ultimately need.

[24] IBLI uptake and volume of TLUs insured are likely correlated with TLUs owned. Thus, including TLUs owned in our baseline model (columns 1 and 4 in Table 4) may partially absorb the covariance between SWB and IBLI/ TLUs insured. As a robustness check, we have run the baseline model, excluding TLUs owned. We find that our core results are robust to this exclusion (Appendix Table A8).

As expected, SWB is positively correlated with various wealth measures. Both livestock and non-livestock assets are positively related to SWB. Male headed households are more likely to report higher SWB than their female headed counterparts. Household size is negatively correlated with SWB.

We find similar results for the volume of TLUs insured (columns 4-6). Vignette corrected SWB is increasing in the predicted number of TLUs insured. In the full model in panel (a) of column 6, a unit increase in the volume of TLUs insured increases the log-odds of reporting higher SWB by 0.14, which translates to 1.15 times more likelihood of reporting higher SWB than lower SWB. The corresponding column in panel (b) shows that an additional unit of TLUs insured reduces the probability of reporting low SWB ($SWB \leq 3$) by 2 percent and increases the probability of reporting high SWB ($SWB \geq 5$) by 2 percent. Yet, as IBLI policies lapse without paying, the more TLUs one had insured, the greater the buyer's remorse one experiences. A unit increase in lapsed TLUs insured reduces the log-odds of reporting higher SWB by 0.07. An IBLI buyer with a unit more lapsed TLUs insured is 1.08 times more likely to report lower SWB than higher SWB. That is, an additional unit of lapsed TLUs insured increases the probability of reporting low SWB ($SWB \leq 3$) by 0.9 percent and reduces the probability of reporting high SWB ($SWB \geq 5$) by 0.8 percent. As is the case with IBLI uptake, the positive effect of greater volume of TLUs insured statistically significantly exceeds the negative remorse it causes when the contract fails to pay out. We also find that livestock and non-livestock wealth are positively correlated with SWB, while household size is negatively correlated with SWB.

In addition to our preferred two-stage estimation results, we provide ITT estimates of the effects of IBLI in Appendix Table A9. In columns 1-3, we present results for the dichotomous discount coupon treatment dummy and in columns 4-6 we present the same set of results for discount coupon values. As expected, the ITT estimates are positive for all randomized incentives, except the poet tape in SP2. The coefficient estimates on discount dummies are statistically significant for assignment in sales period 2

only and for both sales periods 1 and 2. The discount values are statistically significant for sales period 2. The coefficients of poet tape and comic book are statistically insignificant in each period. We suspect this is due to non-compliance in treatment take-up. Joint significance χ^2 tests confirm that the instruments, particularly the discrete discount dummy and information extension, are jointly statistically significantly different from zero. These results seem primarily due to SP2 treatment impacts. Again, the study design was known to be underpowered for ITT estimation. So, these results are entirely consistent with our core findings.

While the structural assumptions that underlie our preferred models involve the risk of specification bias if either the first or second stage model is misspecified, misspecification in linear models doesn't affect the consistency of coefficient estimates. Nonetheless, as a robustness check of our main results, we re-estimate the uptake and TLUs insured equations using two-stage least square (2SLS), and find the 2SLS estimates are consistent with the results from our preferred models in Table 4 (Appendix Table A10). In the 2SLS uptake equations (columns 1-3), the coefficients on active contracts are positive and statistically significant. Likewise, the coefficients on lapsed contracts are negative and statistically significant. The positive coefficients on active contracts are larger in absolute terms than the negative lapsed contract coefficients. Results for the 2SLS TLU insured equations (columns 4-6) are as expected. The coefficients on current contracts and lapsed contracts are positive and negative, respectively. In absolute terms, the positive coefficients on current contracts are larger than the negative coefficients on lapsed contracts. However, the current contract coefficients are statistically insignificant while the negative coefficients on lapsed contracts are significant.

When we examine the regression results from estimating equations (2) and (4) using only currently active IBLI policies, we find that omission of $\widehat{IBLIL}$ leads to a considerably smaller, yet still statistically significant, point estimate on $\widehat{IBLI}$ (Appendix Table A11). This finding underscores the prospective

omitted relevant variable bias on the *ex ante* SWB impact estimate that arises due to autocorrelation in insurance demand if one does not separately control for lapsed policies. In other words, econometric estimates of the gains from insurance will likely underreport the welfare effects of insurance coverage if the research design does not permit the researcher to disentangle the *ex ante* and *ex post* effects of insurance.

The net aggregate SWB effect of IBLI is presented in Table 5. The results in each column is calculated using estimates in the corresponding columns 4-6 in Table 4. The estimated $\Delta\widehat{SWB}_{ivt}$ is positive and statistically significant in the number of TLU insured. The point estimate suggests that insuring an extra TLU increases vignette corrected SWB by 0.2 points, although these units have no specific informational content given the ordinal nature of the dependent variable. But this magnitude indicates that, assuming a constant marginal SWB effect of IBLI, insuring about five TLUs bumps a household up by one rung on the SWB Likert scale, from, for example, "very bad" to "bad" or "good" to "very good", on average. So, even insurance policies that did not pay out generate SWB gains. Given the actual financial losses experienced by households that purchased insurance policies in these poor communities in southern Ethiopia, this finding is important and reassuring.

Table 5 here

Robustness checks

We complete several robustness checks to test whether our findings are sensitive to various specifications and variable definitions. First, we re-estimate our model for vignette corrected SWB relative to Borana pastoralists, a refinement of our dependent variable (Appendix Table A12). The results are consistent with our main findings, suggesting response stability – that the phrasing of questions had little impact. As in the model for vignette adjusted SWB in Table 4, buying IBLI leads

to higher SWB scores. The estimated coefficients on predicted IBLI as well as lapsed IBLI in the two models are comparable. As expected, the coefficients on predicted lapsed IBLI are negative and statistically significant. But, the positive effect of possessing IBLI policies is significantly higher than the negative buyer's remorse effect. The number of TLUs owned is positively related to SWB. As before, a larger household size is associated with lower SWB. Non-livestock assets and gender are, however, statistically insignificant. The results of the regression of SWB relative to Borana pastoralists on the volume of TLUs insured are also consistent with our main results in Table 4. The positive effect of active contracts exceeds the negative buyer's remorse effect of lapsed coverage. The difference is statistically significant.

We then estimate our model using raw SWB, which has not been vignette corrected, for IBLI uptake and volume of TLUs insured (Appendix Table A13). The results are consistent with our main findings: SWB increases with IBLI uptake/ volume of TLUs insured, and livestock and non-livestock wealth. Lapsed IBLI contracts cause remorse, hence negatively impact well-being. Male household heads are more likely to report higher SWB than female household heads. However, the coefficients on predicted IBLI and predicted TLUs insured are not statistically different from the absolute value of the corresponding coefficients on lapsed predicted IBLI uptake and predicted TLUs insured.

We also estimate our model for the balanced panel subsample to verify that the differential weighting of households in the unbalanced panel sample does not influence our estimates. Results for the balanced panel household sub-sample are presented in Appendix Table A14. Again, we find that all of the estimated coefficients are consistent with our main results in Table 4. Predicted IBLI coverage and TLU insured increase vignette adjusted SWB, while lapsed contracts reduce it. The magnitudes of the positive effects of IBLI remain significantly higher than the negative estimated buyer's remorse effects, and comparable to what we find in Table 4. As before, SWB rises with wealth and decreases with

household size. Male household heads report higher SWB. Tests of attrition bias due to households dropping out of the sample indicate that our estimates of IBLI participation and the effect of ILBI on SWB are free of attrition bias (Appendix: Attrition and Appendix Table A15).

The multiple robustness checks we conduct strongly suggest that the positive *ex ante* SWB effects of IBLI coverage, and the negative *ex post* SWB effects of buyer's remorse in response to a lapsed policy that did not pay out, are robust to both definitions of subjective well-being measures, various specifications, and variations in the relevant panel sub-sample. The effects of wealth, gender and household size are also consistent throughout. These results give us more confidence in the robustness of our results.

Conclusions

Interest in the study of subjective well-being (SWB) has increased in recent years, as has research on index insurance in rural areas of the developing world. To date, much of the SWB research in low-income countries has focused on the relationship between SWB and income or assets. There is limited understanding of how institutional factors, access to services, or public policy influence SWB, if at all (Fafchamps and Shilpi 2008). Few studies link policy variables, such as uptake of index based livestock insurance (IBLI), with changes in SWB (Kaminski 2014). This study addresses this important gap in the literature while simultaneously making an important contribution to disentangling the *ex ante* and *ex post* welfare effects of insurance by isolating the buyer's remorse effect that arises from lapsed insurance policies.

We use three rounds of annual household panel data collected between 2012 and 2014, bracketing the introduction of IBLI in southern Ethiopia, and randomized encouragements to buy the product to identify the causal effect of IBLI on SWB. We separate out the *ex ante* SWB effects of current coverage

from the *ex post* buyer's remorse effect, exploiting the fact that some households had purchased IBLI in the second survey round and those policies had lapsed by the third survey round.

We find that current IBLI coverage has a strongly positive and statistically significant effect on SWB. We also find evidence of a statistically significant buyer's remorse effect. The negative buyer's remorse effect is considerably smaller in magnitude than the positive effect of IBLI coverage, however, suggesting that the comfort people derive from insurance coverage more than compensates for any regret they suffer once they realize they did not need coverage. Therefore, in our sample, insurance purchase is *ex ante* optimal, on average.

This could reflect the nature of the sample we study. Pastoralists in southern Ethiopia's Borana Zone face declines in informal social insurance institutions at a time when pastoral livelihoods are becoming riskier. Borana pastoralists may, thus, experience greater well-being as a result of having access to index insurance, even if it did not pay out in the short-term. These results suggest that for people with precarious livelihoods, even an imperfect, commercially priced insurance policy that does not pay out can leave them feeling better off.

We also show that if buyer's remorse effects exist and there is persistence in insurance purchases, such that current and lapsed coverage are positively correlated, then ignoring lapsed policies results in downwardly biased estimates of the well-being effects of insurance. Thus, estimation of the welfare effects of insurance ought not ignore potential *ex post* impacts. Prior purchases of insurance may induce buyer's remorse once a buyer realizes that, in retrospect, costly insurance proved unnecessary. Survey-based SWB measures can capture these prospective effects without resorting to strong assumptions about the arguments and functional form of utility functions.

SWB measures seem especially appropriate to establish the impacts of commercial insurance. Commercial insurance policies, including IBLI, are priced above actuarially fair premium rates to cover the costs of and ensure a profit margin for the underwriter. Thus, buyers intrinsically face a tradeoff between material and non-material well-being. Theory suggests that actuarially fair insurance is welfare enhancing, regardless of whether it pays out, because most people are risk averse and insurance mitigates risk. But when insurance is not actuarially fair, and perhaps especially if it offers incomplete coverage or is subject to basis risk, the *ex ante* expected monetary loss (because premiums exceed expected indemnity payments over time) and the *ex post* buyer's remorse that might result if no insurable loss occurs might negate the oft-assumed benefits of insurance. SWB measures offer a credible way of establishing the net welfare benefits of imperfect, commercial insurance products.

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Table 1: Test of Treatment-Control Covariate Balance at Baseline

	Sales period 1 assignments			Sales period 2 assignments		
	Discount Coupon	No Discount Coupon	Difference (Discount-No Discount)	Discount Coupon	No Discount Coupon	Difference (Discount-No Discount)
	(1)	(2)	(3)	(4)	(5)	(6)
Subjective well-being (SWB)	2.869	2.924	-0.055	2.878	2.887	-0.010
	(0.058)	(0.102)	(0.126)	(0.057)	(0.112)	(0.125)
SWB relative to Borana pastoralists	2.855	2.866	-0.012	2.886	2.746	0.140
	(0.047)	(0.088)	(0.103)	(0.046)	(0.096)	(0.102)
Vignette corrected SWB	3.570	3.741	-0.172	3.556	3.793	-0.238
	(0.076)	(0.145)	(0.167)	(0.075)	(0.146)	(0.165)
Vignette corrected SWB relative to Borana pastoralists	3.628	3.760	-0.132	3.626	3.765	-0.139
	(0.072)	(0.139)	(0.159)	(0.073)	(0.132)	(0.158)
Number of TLUs owned	14.197	17.048	-2.851	14.058	17.529	-3.471

	(1.097)	(2.104)	(2.424)	(0.942)	(3.027)	(2.405)
Non-livestock assets (‘000 Birr)	2.672	3.034	-0.363	2.761	2.684	0.078
	(0.197)	(0.495)	(0.464)	(0.204)	(0.448)	(0.461)
Annual income (‘000 Birr)	20.357	20.106	0.251	19.734	22.512	-2.778
	(2.322)	(2.087)	(4.736)	(1.846)	(5.888)	(4.701)
Expected TLU loss (max=52)	15.252	17.019	-1.767*	15.784	14.933	0.852
	(0.448)	(0.888)	(0.996)	(0.443)	(0.935)	(0.991)
Gender of household head (Male=1)	0.774	0.818	-0.044	0.773	0.821	-0.049
	(0.021)	(0.039)	(0.046)	(0.021)	(0.038)	(0.045)
Age of household head (years)	49.850	49.500	0.350	49.607	50.444	-0.838
	(0.902)	(1.75)	(1.997)	(0.914)	(1.658)	(1.983)
Household size (#)	6.324	5.895	0.430	6.189	6.425	-0.237
	(0.126)	(0.205)	(0.271)	(0.120)	(0.257)	(0.269)
Non-working age hh members (#)	3.567	3.231	0.337*	3.480	3.576	-0.097
	(0.091)	(0.163)	(0.198)	(0.087)	(0.197)	(0.197)
Female hh members (#)	3.122	3.010	0.113	3.064	3.236	-0.173

	(0.078)	(0.135)	(0.169)	(0.075)	(0.162)	(0.168)
Iqub (ROSCAs) membership (%)	0.095	0.058	0.037	0.092	0.064	0.028
	(0.015)	(0.023)	(0.031)	(0.015)	(0.025)	(0.032)
Observations	411	104	515	409	106	515

Note: This table presents the baseline treatment-control covariate balance tests on sales period 1 and sales period 2 treatment assignments. TLU stands for tropical livestock units; ROSCA stands for rotating saving and credit association. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Summary Statistics - Round 2 and 3 Values (Pooled), by Insurance Status

	Insured	Uninsured	Difference (Insured – Uninsured)
	(1)	(2)	(3)
Subjective well-being (SWB)	3.192	3.049	0.143**
	(0.041)	(0.036)	(0.056)
SWB relative to Borana pastoralists	3.250	3.138	0.112**
	(0.038)	(0.034)	(0.053)
Vignette corrected SWB	4.079	3.714	0.365***
	(0.068)	(0.058)	(0.092)
Vignette corrected SWB relative to Borana pastoralists	4.100	3.792	0.308***
	(0.065)	(0.057)	(0.089)
Encouragement design			
Discount coupon	0.932	0.524	0.408***
	(0.013)	(0.020)	(0.027)
Audio tape	0.110	0.039	0.071***
	(0.016)	(0.008)	(0.016)
Comic book	0.165	0.085	0.081***
	(0.019)	(0.011)	(0.020)
Value of discount coupon (%) – SP1	0.353	0.164	0.188***
	(0.016)	(0.010)	(0.018)
Value of discount coupon (%) – SP2	0.278	0.171	0.107***
	(0.016)	(0.011)	(0.082)
Number of TLUs owned	20.592	17.323	3.269*

	(1.671)	(1.050)	(1.874)
Non-livestock assets (‘000 Birr)	4.975	4.630	0.344
	(0.480)	(0.460)	(0.702)
Annual income (‘000 Birr)	20.932	19.180	1.753
	(2.048)	(1.168)	(2.188)
Expected TLU loss (max=52)	13.077	12.989	-0.089
	(0.410)	(0.362)	(0.566)
Gender of household head (Male=1)	0.774	0.807	-0.033
	(0.021)	(0.016)	(0.026)
Age of household head (years)	50.341	51.884	-1.542
	(0.915)	(0.726)	(1.176)
Household size (#)	6.561	6.745	0.183
	(0.125)	(0.105)	(0.167)
Non-working age hh members (#)	3.619	3.754	0.134
	(0.090)	(0.071)	(0.115)
Female hh members (#)	3.276	3.330	0.055
	(0.074)	(0.065)	(0.101)
Iqub (ROSCAs) membership (%)	0.058	0.053	0.005
	(0.012)	(0.009)	(0.015)
Observations	381	639	1020

Note: The table shows summary statistics by insurance status. Columns 3 presents tests for equality of means of insured and uninsured households. SP stands for sales period; TLU stands for tropical livestock units; ROSCA stands for rotating saving and credit association. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 3: First Stage Estimates of IBLI Uptake and Volume of TLUs Insured

	LPM estimates of IBLI uptake		Tobit estimates of volume of TLUs insured	
	(1)	(2)	(3)	(4)
Discount: SP1 only	0.103**	0.108**	3.124***	2.731***
	(0.044)	(0.043)	(0.764)	(0.773)
Discount: SP2 only	0.165***	0.173***	2.988***	2.931***
	(0.046)	(0.044)	(0.765)	(0.768)
Discount: SP1 & SP2	0.084*	0.085*	2.402***	2.036**
	(0.046)	(0.043)	(0.823)	(0.824)
Value of discount (%) SP1	0.002***	0.002***	0.037***	0.041***
	(0.001)	(0.001)	(0.009)	(0.009)
Value of discount (%) SP2	-0.0001	-0.0001	0.033***	0.030***
	(0.001)	(0.001)	(0.009)	(0.009)
Poet tape: SP1 only	0.043	0.063	0.363	0.963
	(0.092)	(0.087)	(1.031)	(1.041)
Poet tape: SP2 only	0.114	0.131*	2.823***	2.803***
	(0.073)	(0.070)	(0.977)	(0.979)
Poet tape: SP2 & SP2	0.129**	0.098	0.836	0.553
	(0.063)	(0.065)	(1.256)	(1.268)
Comic book: SP1 only	0.078	0.063	0.945	0.820
	(0.059)	(0.061)	(0.891)	(0.896)
Comic book: SP2 only	0.068	0.079	1.586*	1.231

	(0.061)	(0.064)	(0.923)	(0.926)
Comic book: SP2 & SP2	0.200***	0.217***	2.632***	2.522***
	(0.073)	(0.071)	(0.787)	(0.812)
IBLI premium: SP1	-	-	0.0003	-0.003
			(0.004)	(0.018)
IBLI premium: SP2	0.0002	0.00002	0.002	0.0001
	(0.0002)	(0.0001)	(0.003)	(0.002)
IBLI knowledge		0.007		0.508***
		(0.006)		(0.129)
Expected TLUs loss		-0.001		-0.004
		(0.002)		(0.023)
Number of TLUs owned		0.002*		0.019**
		(0.001)		(0.008)
Asset index		0.131		0.303
		(0.128)		(0.253)
Annual income (‘000 Birr)		-0.0001		-0.005
		(0.0002)		(0.005)
Household head gender (Male=1)		-0.241*		0.592
		(0.136)		(0.638)
Household head age		0.002		-0.041
		(0.016)		(0.081)
Household age squared		-0.0001		0.0003
		(0.0001)		(0.001)

Household size		0.075***		-0.009
		(0.027)		(0.193)
Household head schooling		-0.003		-0.176
		(0.008)		(0.124)
Iqub membership		-0.070		-1.353*
		(0.049)		(0.748)
Household composition	No	Yes	No	Yes
Round indicator	No	Yes	No	Yes
Constant	0.086	0.482	-8.403***	-8.332***
	(0.132)	(0.902)	(2.280)	(3.488)
Wald weak instrument test (Kleibergen-Paap Wald F-test): P-value	0.000	0.000	0.000	0.0035
Observations	1,015	1,015	1,015	1,015
Number of households	520	520	520	520

Note: The table presents the first stage IBLI uptake and volume of TLUs insured as a function of randomized treatment assignment and other controls. Columns (1) and (2) show LPM estimates of IBLI uptake. The dependent variable *IBLI uptake* is a dummy variable that takes value 1 if a household buys IBLI and 0 otherwise. Standard errors are clustered at the panel-*Reera* level. Columns (3) and (4) show Tobit model estimates of volume of TLUs insured. The dependent variable *TLUs insured* is a non-negative continues variable. The reported standard errors are bootstrap standard errors. The controls for household composition include number of household members by age group and gender: all/ male/ female #members<=5, #mem>5&<=15, #mem>15&<=64, and #mem>=65. SP indicates sales period; TLU indicates tropical livestock units. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Ordered Logit Regression: Vignette Adjusted SWB Estimates Using IBLI Uptake and Volume of TLUs Insured

	IBLI uptake			TLUs insured		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: SWB	panel (a)					
Predicted IBLI/TLUs insured	0.816***	0.713***	0.859***	0.137***	0.138***	0.144***
	(0.264)	(0.256)	(0.290)	(0.041)	(0.040)	(0.041)
Predicted lapsed IBLI/TLUs	-0.454**	-0.439**	-0.442**	-0.077**	-0.071**	-0.074**
	(0.191)	(0.197)	(0.198)	(0.030)	(0.031)	(0.030)
Number of TLUs owned	0.015**	0.012*	0.012*	0.015**	0.012*	0.012*
	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)
Asset index		0.283**	0.239**		0.325***	0.289***
		(0.114)	(0.120)		(0.102)	(0.101)
Annual income (‘000 Birr)		0.003	0.004		0.003	0.003
		(0.002)	(0.002)		(0.002)	(0.002)
Household head gender						
(Male=1)			0.733**			0.617*
			(0.358)			(0.334)
Household head age			-0.042			-0.037
			(0.040)			(0.038)
Household head age squared			0.000			0.000
			(0.000)			(0.000)
Household size			-0.224**			-0.193**
			(0.090)			(0.085)

Household head schooling			0.055			0.058
			(0.051)			(0.053)
			panel (b)			
Predicted IBLI/TLUs insured						
prob(SWB=1)	-0.042***	-0.037***	-0.044***	-0.007***	-0.007***	-0.007***
	(0.014)	(0.014)	(0.015)	(0.002)	(0.002)	(0.002)
prob(SWB=2)	-0.033***	-0.029***	-0.035***	-0.006***	-0.006***	-0.006***
	(0.011)	(0.011)	(0.012)	(0.002)	(0.002)	(0.002)
prob(SWB=3)	-0.025***	-0.021**	-0.026***	-0.004***	-0.004***	-0.004***
	(0.009)	(0.008)	(0.009)	(0.001)	(0.001)	(0.001)
prob(SWB=4)	0.005**	0.005*	0.007*	0.001*	0.001*	0.001*
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
prob(SWB=5)	0.052***	0.045***	0.055***	0.009***	0.009***	0.009***
	(0.018)	(0.017)	(0.019)	(0.003)	(0.003)	(0.003)
prob(SWB=6)	0.027***	0.023***	0.028***	0.005***	0.004***	0.005***
	(0.009)	(0.009)	(0.009)	(0.001)	(0.001)	(0.001)
prob(SWB=7)	0.015***	0.013**	0.016***	0.003***	0.003***	0.003***
	(0.005)	(0.005)	(0.006)	(0.001)	(0.001)	(0.001)
Predicted lapsed IBLI/TLUs insured						
prob(SWB=1)	0.024**	0.023**	0.023**	0.004**	0.004**	0.004**
	(0.010)	(0.011)	(0.011)	(0.002)	(0.002)	(0.002)
prob(SWB=2)	0.018**	0.018**	0.018**	0.003**	0.003**	0.003**

	(0.008)	(0.008)	(0.008)	(0.001)	(0.001)	(0.001)
prob(SWB=3)	0.014**	0.013**	0.013**	0.002**	0.002**	0.002**
	(0.006)	(0.006)	(0.007)	(0.001)	(0.001)	(0.001)
prob(SWB=4)	-0.003*	-0.003	-0.003*	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.0003)	(0.0003)	(0.0004)
prob(SWB=5)	-0.029**	-0.028**	-0.028**	-0.005**	-0.005**	-0.005**
	(0.013)	(0.013)	(0.013)	(0.002)	(0.002)	(0.002)
prob(SWB=6)	-0.015**	-0.014**	-0.014**	-0.003**	-0.002**	-0.002**
	(0.007)	(0.007)	(0.007)	(0.001)	(0.001)	(0.001)
prob(SWB=7)	-0.009**	-0.008**	-0.008**	-0.001**	-0.001**	-0.001**
	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)
Number of TLUs owned						
prob(SWB=1)	-0.001**	-0.001*	-0.001*	-0.001**	-0.001*	-0.001*
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)
prob(SWB=2)	-0.001**	-0.0005*	-0.0005*	-0.001**	-0.0005*	-0.0005*
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
prob(SWB=3)	-0.0004**	-0.0004*	-0.0004	-0.0005**	-0.0004*	-0.0004*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
prob(SWB=4)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.00001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
prob(SWB=5)	0.001**	0.001*	0.001*	0.001**	0.001*	0.001*
	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0004)
prob(SWB=6)	0.0005**	0.0004*	0.0004*	0.0005**	0.0004*	0.0004*

	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
prob(SWB=7)	0.0003**	0.0002*	0.0002*	0.0003**	0.0002*	0.0002*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Household composition	No	No	Yes	No	No	Yes
Round dummy	No	No	Yes	No	No	Yes
Observations	1,530	1,530	1,530	1,530	1,530	1,530
Number of households	550	550	550	550	550	550

Note: The table presents the effects of IBLI on vignette-corrected SWB. Columns 1-3 show the extensive margin effects of buying IBLI. Column 4-6 show the intensive margin effects of volume of TLUs insured. Panel (a) reports the effects of IBLI uptake and volume of TLUs insured on vignette adjusted SWB in log-odds units. Panel (b) reports the marginal effects for the main results in panel (a) – IBLI/TLUs insured, lapsed IBLI/ TLUs insured and number of TLUs owned. The marginal effects estimates in panel (b) show the effects of these variables on the probability of reporting one of the seven unique scales of SWB. In column 3 for example, IBLI uptake reduces the probability of reporting SWB=1 by 4.4% and increases the probability of reporting SWB=7 by 1.6%. A unit increase in TLUs owned reduces the probability of reporting SWB=1 by 0.1% and increases the probability of reporting SWB=7 by 0.02%. TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Aggregate Effect of IBLI on SWB

Variables	(1)	(2)	(3)
$\Delta\widehat{SWB}_{ivt}$	0.197***	0.202***	0.213***
	(0.060)	(0.060)	(0.060)
Observations	1,530	1,530	1,530

Note: This table shows the aggregate effects of IBLI on SWB. It is calculated using predicted volume of tropical livestock units (TLUs) insured due to assignment to treatment, predicted volume of TLUs insured that lapsed without payout, and the net indemnity payout associated with IBLI coverage. Bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

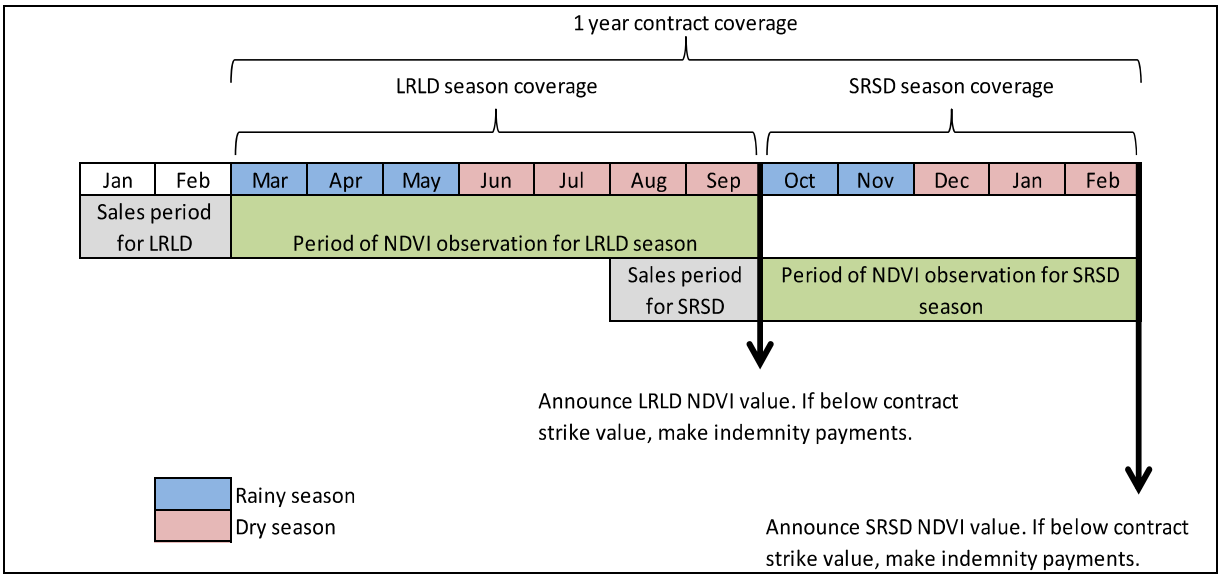

Figure 1: Temporal structure of IBLI contract

Note: LRLD indicates the long rains, long dry season. SRSD indicates the short rains, short dry season.

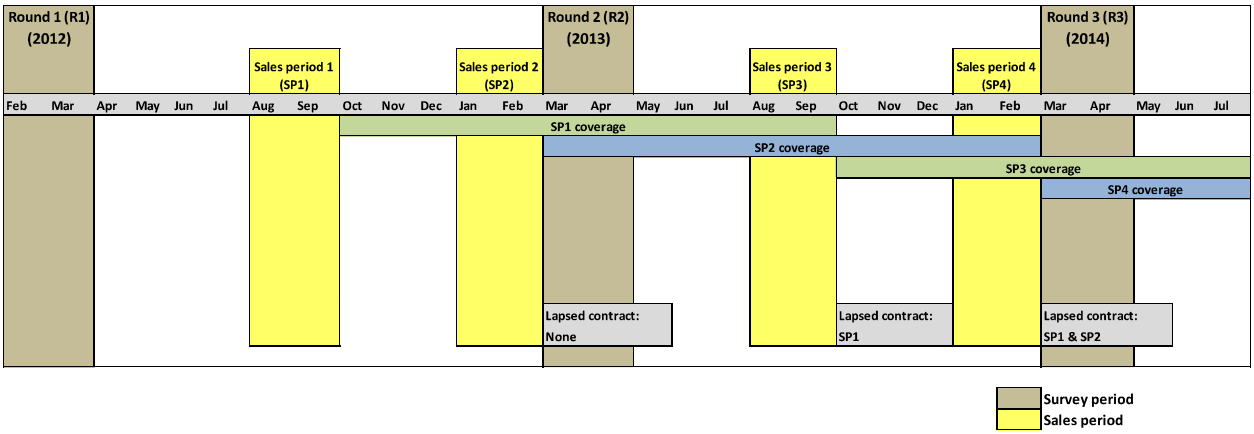

Figure 2: Timeline of IBLI survey and sales

APPENDIX

Table A1: Experimental Design

	August-September 2012				January-February 2013				August-September 2013				January-February 2014			
	Discount coupon	Comic book	Poet tape	None	Discount coupon	Comic book	Poet tape	None	Discount coupon	Comic book	Poet tape	None	Discount coupon	Comic book	Poet tape	None
Discount coupon	**412**				**411**				**408**				**409**			
	(79.8)				(79.8)				(80.3)				(79.3)			
Comic book	86	**108**			82	**99**			0	**0**			0	**0**		
	(16.7)	(20.93)			(15.9)	(19.2)			(0)	(0)			(0)	(0)		
Poet tape	66	0	**86**		56	0	**71**		0	0	**0**		0	0	**0**	
	(12.8)		(16.7)		(10.9)		(13.8)		(0)	(0)	(0)		(0)	(0)	(0)	
None	0	0	0	**62**	0	0	0	**66**				**100**				**107**
				(12.0)				(12.8)				(19.7)				(20.1)
Sample				**516**				**515**				**508**				**516**

Note: The table presents the experimental design of the study. In sales periods 1 and 2, the encouragement design includes randomized distribution of discount coupons and comic book and poet tape information treatments. The information treatments were discontinued in sales periods 3 and 4. In the experimental design, some households received discount coupon only, some received one of the two information treatments only, and others received a combination of discount coupon and one of the information treatments. None received

comic book and poet tape information treatments. For example, in sales period 1, a total of 412, 108, and 86 households received discount coupon, comic book and poet tape treatments, respectively. Out of the 412 discount coupon recipients, 86 received discount coupon and comic book information treatment, 66 received discount coupon and poet tape treatment and 260 households received discount coupon treatment only. The percentage of respondents assigned to the various treatment arms in each sales period is presented in the parenthesis.

Table A2: Annual IBLI Premium and Out of Pocket Payments

Woreda	Aug-Sept 2012; Jan-Feb 2013; Aug-Sept 2013							Jan-Feb 2014						
	Premium (Birr)					TLUs insured	Out of pocket pay per TLU (Birr)[a]	Premium (Birr)					TLUs insured	Out of pocket pay per TLU (Birr)[a]
	(%)	Cattle	Camel	Goat/ Sheep	TLU			(%)	Cattle	Camel	Goat/ Sheep	TLU		
Dillo	9.8	488	1463	68	739	1.3	450	8.6	516	860	69	606	0.4	324
Teltele	8.7	436	1307	61	660	3.1	385	7.7	462	770	62	543	3.3	236
Yabello	7.5	377	1131	53	571	3.1	289	6.7	402	670	54	472	2.1	240
Dire	9.5	475	1424	66	719	1.6	413	8.4	504	840	67	592	1.7	296
Arero	8.6	429	1287	60	650	2.9	333	7.6	456	760	61	536	4.1	300
Dehas	9.4	468	1404	66	709	3.0	343	8.3	498	830	66	585	4.0	234
Miyo	11.1	553	1658	77	837	0.9	442	9.8	588	980	78	691	2.5	414
Moyale	11.1	553	1658	77	837	1.2	566	9.8	588	980	78	691	0.0	-
Overall		461	1382	65	698	2.3	384		489.4	815.7	65	575	2.4	279

Source: ILRI 2013 and own calculation.

Note: [a] Average out of pocket payment per TLU by actual buyers.

Table A3: Variable Definitions

General information	***Description***
Round 1	Baseline – conducted: March/April, 2012
Round 2	Conducted: March/April, 2013
Round 3	Conducted: March 2014
Sales period 1	August-September 2012; contract active- October 2012-September 2013; Encouragement design- discount coupon, poet tape, comic book
Sales period 2	January-February 2013; contract active- March 2013-February 2014; Encouragement design- discount coupon, poet tape, comic book
Sales period 3	August-September 2013; contract active- October 2013-September 2014; Encouragement design- discount coupon only
Sales period 4	January-February 2014; contract active- March 2014-February 2015; Encouragement design- discount coupon only
Variable	***Definition***
SWB	An ordinal scale of respondents' stated perception of their economic condition on a Likert scale ranging from 1=very bad to 5= very good. It's the answer to the question "*On which step do you place your present economic conditions?*"
SWB relative to Borana pastoralists	Response the question "*In general, how do you rate your living conditions compared to those of other Borana pastoralists?*" 1=much worse; …; 5=much better

Discount coupon	A dummy variable taking value 1 if a household received discount coupon and 0 otherwise.
Audio tape	A dummy variable taking value 1 if a household received additional information treatment via audio tape and 0 otherwise.
Comic book	A dummy variable taking value 1 if a household received additional information via comic book and 0 otherwise.
Value of discount coupon	The amount of discount received, in percentages, which ranges between 0 and 100%.
Number of TLU owned	A standardized measure of livestock holding. It is obtained by multiplying number of livestock by the relevant TLU conversion unit for each livestock type. The conversion units used are TLU=1 for cattle, TLU=1.4 for camel, and TLU=0.1 for goats and sheep, collectively called shoats.
Non-Livestock assets	Value of non-livestock assets in Birr. It includes assets such as bed frame, mattress, chair, table, bicycle, motorcycle, car, cellphone, computer, television, radio, wheelbarrow, grind mill, axe, spade, sickle, hoe, watch, jewelry etc.
Expected TLU loss	Constructed from a set of questions that ask responds how many of 20 livestock (by type) they expect to die in the coming year. These figures are converted to common TLUs. Thus, results should be read against a total of 52 tropical livestock units. The questions used are "*what is the number out of 20 X do you expect to die over the March 2013 to February 2014 period?*" X here stands for livestock types.

Insurance premium	Insurance premium per TLU. Insurance premium vary by livestock type and Woreda. Some households in the sample also received discount. To reflect this variation, premium is calculated as: (1-% discount) × (premium_cattle×1+premium_camel×1.4+premium_shoats×0.1)/3.
Cash income	Includes cash income (in 1,000 Birr) from sale of livestock and livestock products, crop sales, wages and salaries, business and trading (petty trading, motorcycle services etc), cash for work (bush clearing, pond digging etc), mining etc.
Net transfers	The value of annual net cash transfers (during the four seasons: long dry, long rainy, short dry and short rainy). It includes both cash and in kind transfers. It is the difference between transfers received and transfers given.
Value of food aid	The value of annual food aid (in 1,000 Birr) received by households. It is calculated by multiplying the value of monthly food aid by the number of months food aid is received.
Non-food assistance	The value of annual non-food assistance (in 1,000 Birr). It includes value of annual should feeding, supplementary feeding, income from employment program, and non-food aid. The value of non-food aid consists of non-food aid from government, NGOs, and PSNP program – e.g., water, fodder, vaccination, cash transfers via PSNP.
Annual Income	The sum of annual cash income, value of auto-consumption, net transfers, food aid, and non-food assistance in 1,000 Birr.

Price per TLU	The average price of a TLU equivalent calculated by weighting prices for shoats, cattle, and camel at Haro Bake livestock market in Borana zone by each species' TLU conversion unit. More specifically, we used Birr 700 for shoats price, Birr 5,000 for cattle price and Birr 15,000 for camel price. The TLU conversion unit for shoats is 0.1, for cattle 1 and camel 1.4. Thus, price per TLU=0.1×700 + 1×5,000 + 1.4×15,000 = Birr 7,571.4.
Asset Index	An index constructed from the current value of non-livestock assets using the principal component factor (PCF) method.
Household size	The number of people who live in the same homestead including people who are away temporarily for less than eight months.
Number of non-working age household members	Includes household members 14 years old and under and 65 years and above.
Iqub membership	Iqub is an informal rotating saving and credit organization (ROSCA). The variable takes value 1 if a household member is a member of Iqub, and 0 otherwise.

Note: This table presents the definitions of the key variables used in this paper. TLU stands for tropical livestock units; NGO represents non-governmental organization; PSNP represents productive safety net program.

Table A4: Joint Orthogonality Test for Selection into Treatment

	Aug-Sep sales period			Jan-Feb sales period		
	Discount coupon	Comic book	Audio tape	Discount coupon	Comic book	Audio tape
	(1)	(2)	(3)	(4)	(5)	(6)
Expected TLU loss	-0.002	0.001	0.001	0.001	-0.000	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number of TLUs owned	-0.001**	0.001	-0.000	-0.001	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Asset index	0.010	-0.033	-0.038**	0.012	-0.030	-0.029
	(0.014)	(0.021)	(0.018)	(0.014)	(0.021)	(0.018)
Annual income (‘000 Birr)	0.000	0.000	-0.000	0.000	0.000	-0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Household head gender (Male=1)	-0.077**	-0.000	-0.018	-0.043	-0.009	-0.044
	(0.034)	(0.048)	(0.041)	(0.034)	(0.049)	(0.042)
Household head age	-0.000	-0.000	-0.000	0.000	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Household size	0.018*	0.020	0.011	0.008	0.002	0.019
	(0.010)	(0.014)	(0.012)	(0.010)	(0.014)	(0.012)
Household head schooling	0.005	0.006	-0.006	0.002	0.014	-0.010
	(0.007)	(0.010)	(0.009)	(0.007)	(0.010)	(0.009)
Number of females in household	-0.024**	-0.017	-0.010	-0.010	0.003	-0.014

	(0.012)	(0.017)	(0.015)	(0.012)	(0.018)	(0.015)
Number of working age household members	-0.010	-0.022	0.013	-0.017	0.006	0.004
	(0.013)	(0.019)	(0.016)	(0.013)	(0.019)	(0.017)
Iqub membership	0.056	0.111*	-0.039	0.015	-0.010	-0.020
	(0.049)	(0.065)	(0.055)	(0.049)	(0.066)	(0.056)
Constant	0.909***	0.130	0.078	0.868***	0.084	0.070
	(0.058)	(0.083)	(0.071)	(0.059)	(0.084)	(0.072)
Observations	968	473	473	968	473	473
Prob > F	0.144	0.463	0.411	0.729	0.840	0.129
R-squared	0.016	0.023	0.024	0.008	0.014	0.035

Note: This table presents joint tests of orthogonality for the treatment variables. Prior to sales period 1 (Aug-Sep 2012) and sales period 2 (Jan-Feb 2013), discount coupons as well as audio tape and comic book information treatments were distributed to randomly selected sub-sample of survey households. Similarly, prior to sales period 3 (Aug-Sep 2013) and sales period 4 (Jan-Feb 2014) discount coupons were distributed to randomly selected households. Columns 1-3 and 4-6 show the linear probability model (LPM) regressions of assignment into discount coupon, comic book and audio tape treatment in the Aug-Sep and Jan-Feb sales periods, respectively, on lagged household characteristics using a pooled sample from rounds 2 and 3. Note that the sample includes baseline households who were re-interviewed in R2 and R2 households re-interviewed in R3. The joint orthogonality test (F-test) is reported in the second bottom row. TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A5: Comparison of Uncorrected SWB and Vignette Corrected SWB

a) SWB and vignette corrected SWB

	Vignette corrected SWB							
SWB	1	2	3	4	5	6	7	Total
Very bad (1)	27	93	0	0	0	0	0	120
Bad (2)	31	30	115	74	15	0	0	265
Neither good nor bad (3)	65	22	147	224	221	5	5	689
Good (4)	29	7	23	85	183	34	9	370
Very good (5)	0	5	0	8	0	58	17	88
Total	152	157	285	391	419	97	31	1,532

b) SWB relative to Borana pastoralists and vignette-corrected SWB relative to Borana pastoralists

	Vignette corrected SWB relative to Borana households							
SWB_Borana	1	2	3	4	5	6	7	Total
Much worse (1)	13	51	0	0	0	0	0	64
Worse (2)	28	32	145	88	21	0	1	315
Same (3)	67	19	154	181	194	5	6	626
Better (4)	31	15	27	92	266	59	13	503
Much better (5)	0	2	0	2	0	13	7	24
Total	139	119	326	363	481	77	27	1,532

Note: This table compares raw SWB with vignette-corrected subjective wellbeing. Panel (a) shows how raw (and reference free) SWB compares with vignette-corrected (and reference free) SWB. Panel (b) shows raw (referenced – relative to Borana pastoralists) SWB compares with vignette-corrected (referenced – relative to Borana pastoralists) SWB.

Table A6: The Effect of IBLI on Household Incomes

	Cash income	Non-cash (autoconsumed) income	Total income
	(1)	(2)	(3)
IBLI	0.067	3.836	3.992
	(2.689)	(3.331)	(4.376)
Constant	10.374***	5.226***	18.377***
	(1.179)	(1.461)	(1.919)
Observations	1,015	1,015	1,015
Number of households	520	520	520

Note: The table presents fixed effects estimates of the effects of IBLI on cash income, imputed income from autoconsumption of own production, and total income (cash plus autoconsumption). Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A7: Probit Estimates of IBLI Uptake

Dependent variable: IBLI uptake	(1)	(2)
Discount: SP1 only	1.865***	1.633***
	(0.308)	(0.309)
Discount: SP2 only	1.861***	1.754***
	(0.367)	(0.350)
Discount: SP1 & SP2	1.661***	1.445***
	(0.393)	(0.368)
Value of discount (%) SP1	0.956**	0.955**
	(0.390)	(0.406)
Value of discount (%) SP2	0.163	0.030
	(0.367)	(0.350)
Poet tape: SP1 only	0.672	0.827
	(0.709)	(0.712)
Poet tape: SP2 only	1.381***	1.336***
	(0.337)	(0.317)
Poet tape: SP2 & SP2	0.237	0.115
	(0.461)	(0.429)
Comic book: SP1 only	0.770	0.777*
	(0.478)	(0.434)
Comic book: SP2 only	0.344	0.121
	(0.426)	(0.427)
Comic book: SP2 & SP2	0.921*	0.799

	(0.508)	(0.535)
IBLI premium: SP1	2.725	-0.846
	(1.738)	(8.931)
IBLI premium: SP2	1.905	4.095
	(1.640)	(10.080)
IBLI knowledge		0.232***
		(0.055)
Expected TLUs loss		-0.001
		(0.012)
Number of TLUs owned		0.006
		(0.004)
Asset index		0.028
		(0.097)
Annual income (‘000 Birr)		-0.001
		(0.002)
Household head gender (Male=1)		-0.216
		(0.230)
Household head age		-0.022
		(0.026)
Household age squared		0.0002
		(0.0002)
Household size		0.008
		(0.057)

Household head schooling		-0.025
		(0.048)
Iqub membership		-0.362
		(0.282)
Household composition	No	Yes
Round indicator	No	Yes
Constant	-4.647***	-4.191**
	(1.684)	(1.779)
Observations	1,015	1,015
Number of households	520	520

Note: The table presents the probit estimates of IBLI uptake as function of randomized treatment variables and household characteristics. SP stands for sales period; TLU stands for tropical livestock units. Clustered standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A8: Ordered Logit Regression: Vignette Adjusted SWB Estimates Using IBLI Uptake and Volume of TLUs Insured Excluding Income & TLUs Owned

	(1)	(2)
Dependent variable:	IBLI uptake	TLUs insured
Predicted IBLI	0.979***	
	(0.281)	
Predicted lapsed IBLI	-0.428***	
	(0.156)	
Predicted TLUs insured		0.156***
		(0.040)
Predicted lapsed TLUs insured		-0.074***
		(0.025)
Observations	1,530	1,530
Number of households	550	550

Note: The table presents the results of the baseline model in Table 4 excluding income and TLUs owned as regressors. Column 1 shows results for IBLI uptake dummy and column 2 shows results for volume of TLUs insured. TLU stands for tropical livestock units. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A9: Ordered Logit Regression: ITT Estimates of the SWB Effects of IBLI

	Discount dummy			Discount rate		
Dependent variable: SWB	(1)	(2)	(3)	(4)	(5)	(6)
Discount: SP1 only	0.262	0.146	0.140			
	(0.183)	(0.196)	(0.189)			
Discount: SP2 only	0.457**	0.429**	0.422*			
	(0.206)	(0.211)	(0.217)			
Discount: SP1 & SP2	0.499***	0.474***	0.431***			
	(0.138)	(0.137)	(0.145)			
Value of discount (%) SP1				0.002	0.001	0.0004
				(0.002)	(0.002)	(0.002)
Value of discount (%) SP2				0.004**	0.004**	0.003*
				(0.002)	(0.002)	(0.002)
Poet tape: SP1 only		0.563	0.505		0.582	0.529
		(0.595)	(0.590)		(0.597)	(0.599)
Poet tape: SP2 only		-0.240	-0.200		-0.162	-0.121
		(0.231)	(0.223)		(0.228)	(0.220)
Poet tape: SP2 & SP2		0.306	0.281		0.419	0.397
		(0.675)	(0.672)		(0.669)	(0.669)
Comic book: SP1 only		0.851	0.820		0.906	0.875
		(0.591)	(0.617)		(0.581)	(0.608)
Comic book: SP2 only		0.180	0.239		0.280	0.345
		(0.243)	(0.252)		(0.256)	(0.268)

Comic book: SP2 & SP2	0.082	0.108	0.190	0.212
	(0.243)	(0.242)	(0.247)	(0.246)
Number of TLUs owned		0.013*		0.013*
		(0.007)		(0.007)
Asset index		0.304***		0.293***
		(0.066)		(0.063)
Annual income (‘000 Birr)		0.003		0.003
		(0.003)		(0.002)
Household head gender (Male=1)		0.644**		0.620**
		(0.310)		(0.313)
Household head age		-0.040		-0.040
		(0.032)		(0.032)
Household age squared		0.000		0.000
		(0.000)		(0.000)
Household size		-0.202***		-0.190***
		(0.070)		(0.071)
Household head schooling		0.053		0.056
		(0.054)		(0.054)
Joint significance Chi-square test (p-value):				
All incentives	0.0005	0.0003	0.103	0.126
SP1 incentives	0.227	0.317	0.220	0.342
SP2 incentives	0.108	0.102	0.034	0.038

Observations	1,530	1,530	1,530	1,530	1,530	1,530
Number of households	550	550	550	550	550	550

Note: This table presents the intent to treat (ITT) estimates of the effects of IBLI on SWB. Columns 1 – 3 show estimates using discount coupon treatment dummy, whereas columns 4 – 6 show estimates using discount values. SP stands for sales period. TLU stands for tropical livestock units. SP indicates sales period; TLU indicates tropical livestock units. Clustered standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A10: 2SLS Regression: Vignette Adjusted SWB Estimates Using IBLI Uptake and Volume of TLUs Insured

	IBLI uptake			TLUs insured		
Dependent variable: SWB	(1)	(2)	(3)	(4)	(5)	(6)
IBLI/TLUs insured	0.441***	0.401***	0.473***	0.052	0.050	0.053
	(0.130)	(0.130)	(0.140)	(0.041)	(0.040)	(0.041)
Lapsed IBLI/TLUs	-0.197**	-0.188**	-0.192**	-0.018	-0.013	-0.017
	(0.093)	(0.094)	(0.094)	(0.032)	(0.033)	(0.032)
Number of TLUs owned	0.006**	0.005*	0.005*	0.007***	0.005**	0.005**
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Asset index		0.114**	0.094*		0.135***	0.118***
		(0.053)	(0.055)		(0.044)	(0.043)
Annual income (‘000 Birr)		0.001	0.001		0.001	0.001
		(0.001)	(0.001)		(0.001)	(0.001)
Household head gender (Male=1)			0.353**			0.273**
			(0.151)			(0.135)
Household head age			-0.017			-0.015
			(0.017)			(0.015)
Household head age squared			0.000			0.000
			(0.000)			(0.000)
Household size			-0.104***			-0.080**
			(0.040)			(0.037)

Household head schooling			0.018			0.021
			(0.021)			(0.021)
	3.584***	3.584***	3.686***	3.624***	3.620***	3.760***
	(0.067)	(0.070)	(0.440)	(0.067)	(0.068)	(0.389)
Observations	1,530	1,530	1,530	1,530	1,530	1,530
Number of hhid	550	550	550	550	550	550

Note: The table presents the two-stage least squares (2SLS) estimates of SWB effects of IBLI using IBLI uptake dummy and TLUs insured as main regressors. TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A11: Ordered Logit Regression: Vignette Adjusted SWB Estimates Using IBLI Uptake and Volume of TLUs Insured and Omitting Lapsed IBLI

	IBLI uptake			TLUs insured		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: SWB	panel (a)					
Predicted IBLI/TLUs insured	0.641***	0.552**	0.704**	0.105***	0.108***	0.115***
	(0.245)	(0.249)	(0.282)	(0.037)	(0.037)	(0.038)
Number of IBLI/TLUs owned	0.014**	0.012*	0.012*	0.015**	0.011*	0.012*
	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)
Asset index		0.286**	0.243**		0.329***	0.296***
		(0.116)	(0.123)		(0.103)	(0.102)
Annual income (‘000 Birr)		0.004	0.004		0.004	0.004
		(0.002)	(0.002)		(0.002)	(0.002)
Household head gender						
(Male=1)			0.747**			0.635*
			(0.360)			(0.333)
Household head age			-0.046			-0.040
			(0.040)			(0.038)
Household head age squared			0.000			0.000
			(0.000)			(0.000)
Household size			-0.229**			-0.197**
			(0.090)			(0.085)
Household head schooling			0.049			0.051

			(0.051)			(0.052)
	panel (b)					
Predicted IBLI/TLUs insured						
prob(SWB=1)	-0.033***	-0.029**	-0.036**	-0.005**	-0.006***	-0.006***
	(0.013)	(0.013)	(0.014)	(0.002)	(0.002)	(0.002)
prob(SWB=2)	-0.026**	-0.022**	-0.029**	-0.004**	-0.004**	-0.005***
	(0.010)	(0.010)	(0.011)	(0.002)	(0.002)	(0.002)
prob(SWB=3)	-0.019**	-0.016**	-0.021**	-0.003**	-0.003***	-0.003***
	(0.008)	(0.008)	(0.009)	(0.001)	(0.001)	(0.001)
prob(SWB=4)	0.004*	0.004	0.005*	0.001	0.001	0.001
	(0.002)	(0.002)	(0.003)	(0.0005)	(0.0005)	(0.001)
prob(SWB=5)	0.041**	0.035**	0.045**	0.007**	0.007***	0.007***
	(0.016)	(0.016)	(0.018)	(0.003)	(0.003)	(0.003)
prob(SWB=6)	0.021***	0.018**	0.023***	0.003***	0.004***	0.004***
	(0.008)	(0.008)	(0.009)	(0.001)	(0.001)	(0.001)
prob(SWB=7)	0.012**	0.010**	0.013**	0.002**	0.002**	0.002**
	(0.005)	(0.005)	(0.005)	(0.001)	(0.001)	(0.001)
Number of TLUs owned						
prob(SWB=1)	-0.001**	-0.001*	-0.001*	-0.001**	-0.001*	-0.001*
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0004)
prob(SWB=2)	-0.001**	-0.0005*	-0.000*	-0.001**	-0.0005*	-0.0005*
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
prob(SWB=3)	-0.0004**	-0.0003	-0.0004	-0.0004**	-0.0003	-0.0004*

	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
prob(SWB=4)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
prob(SWB=5)	0.001**	0.001*	0.001*	0.001**	0.001*	0.001*
	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0004)
prob(SWB=6)	0.0005**	0.0004*	0.0004*	0.0005**	0.0004*	0.0004*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
prob(SWB=7)	0.0003**	0.0002*	0.0002	0.0003**	0.0002*	0.0002*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Household composition	No	No	Yes	No	No	Yes
Round dummy	No	No	Yes	No	No	Yes
Observations	1,530	1,530	1,530	1,530	1,530	1,530
Number of households	550	550	550	550	550	550

Note: Panel (a) reports the effects of IBLI uptake and volume of TLUs insured on vignette adjusted SWB when lagged IBLI/ TLUs insured is omitted, in log-odds units. Panel (b) reports the marginal effects for the main results in panel (a) IBLI/ TLUs insured and number of TLUs owned. The marginal effects estimates in panel (b) show the effects of these variables on the probability of reporting one of the seven unique scales of SWB. In column 3, IBLI uptake reduces the probability of reporting SWB=1 by 3.6% and increases the probability of reporting SWB=7 by 1.3%. In column 6, a unit increase in the number of TLUs insured reduces the probability of reporting SWB=1 by 0.6% and increases the probability of reporting SWB=7 by 0.2%. TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A12: Ordered Logit Regression: Estimates for Vignette Adjusted SWB Relative to Borana Pastoralists Using IBLI Uptake and Volume of TLUs Insured

	IBLI uptake			TLUs insured		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: SWB	panel (a)					
Predicted IBLI/TLUs insured	0.942***	0.930***	1.070***	0.179***	0.179***	0.188***
	(0.269)	(0.273)	(0.290)	(0.040)	(0.040)	(0.041)
Predicted lapsed IBLI/TLUs	-0.351*	-0.336*	-0.364*	-0.075**	-0.072**	-0.080**
	(0.200)	(0.199)	(0.201)	(0.033)	(0.032)	(0.033)
Number of TLUs owned	0.010**	0.009*	0.009*	0.010**	0.009**	0.009**
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
Asset index		0.044	-0.006		0.103	0.060
		(0.141)	(0.145)		(0.123)	(0.120)
Annual income (‘000 Birr)		0.002	0.002		0.001	0.002
		(0.001)	(0.001)		(0.001)	(0.001)
Household head gender						
(Male=1)			0.593			0.436
			(0.366)			(0.337)
Household head age			-0.044			-0.037
			(0.041)			(0.038)
Household head age squared			0.0004			0.000
			(0.0003)			(0.000)
Household size			-0.232**			-0.187**

			(0.093)			(0.088)
Household head schooling			0.071			0.077*
			(0.045)			(0.046)
	panel (b)					
Predicted IBLI/TLUs insured						
prob(SWB=1)	-0.043***	-0.043***	-0.049***	-0.008***	-0.008***	-0.009***
	(0.013)	(0.013)	(0.014)	(0.002)	(0.002)	(0.002)
prob(SWB=2)	-0.031***	-0.031***	-0.036***	-0.006***	-0.006***	-0.006***
	(0.009)	(0.010)	(0.010)	(0.002)	(0.002)	(0.002)
prob(SWB=3)	-0.037***	-0.037***	-0.042***	-0.007***	-0.007***	-0.007***
	(0.012)	(0.012)	(0.012)	(0.002)	(0.002)	(0.002)
prob(SWB=4)	0.002	0.002	0.003	0.0004	0.0004	0.001
	(0.002)	(0.002)	(0.003)	(0.0004)	(0.0005)	(0.001)
prob(SWB=5)	0.067***	0.066***	0.077***	0.013***	0.013***	0.013***
	(0.020)	(0.021)	(0.021)	(0.003)	(0.003)	(0.003)
prob(SWB=6)	0.027***	0.027***	0.030***	0.005***	0.005***	0.005***
	(0.008)	(0.009)	(0.009)	(0.001)	(0.001)	(0.001)
prob(SWB=7)	0.015***	0.015***	0.017***	0.003***	0.003***	0.003***
	(0.005)	(0.005)	(0.005)	(0.001)	(0.001)	(0.001)
Predicted lapsed IBLI/TLUs insured						
prob(SWB=1)	0.016*	0.016*	0.017*	0.003**	0.003**	0.004**
	(0.009)	(0.009)	(0.009)	(0.001)	(0.001)	(0.001)

prob(SWB=2)	0.012*	0.011*	0.012*	0.002**	0.002**	0.003**
	(0.006)	(0.006)	(0.006)	(0.001)	(0.001)	(0.001)
prob(SWB=3)	0.014*	0.013*	0.014*	0.003**	0.003**	0.003**
	(0.008)	(0.008)	(0.008)	(0.001)	(0.001)	(0.001)
prob(SWB=4)	-0.001	-0.001	-0.001	-0.0002	-0.0002	-0.0002
	(0.001)	(0.001)	(0.001)	(0.0002)	(0.0002)	(0.0003)
prob(SWB=5)	-0.025*	-0.024*	-0.026*	-0.005**	-0.005**	-0.006**
	(0.014)	(0.013)	(0.014)	(0.002)	(0.002)	(0.002)
prob(SWB=6)	-0.010*	-0.010*	-0.010*	-0.002**	-0.002**	-0.002**
	(0.006)	(0.005)	(0.006)	(0.001)	(0.001)	(0.001)
prob(SWB=7)	-0.006*	-0.005*	-0.006*	-0.001**	-0.001**	-0.001**
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
Number of TLUs owned						
prob(SWB=1)	-0.0004**	-0.0004*	-0.0004*	-0.0005**	-0.0004*	-0.0004*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
prob(SWB=2)	-0.0003**	-0.0003*	-0.0003*	-0.0003**	-0.0003*	-0.0003*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
prob(SWB=3)	-0.0004**	-0.0004*	-0.0003*	-0.0004**	-0.0004*	-0.0004*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
prob(SWB=4)	0.00002	0.00002	0.00003	0.00002	0.00002	0.00003
	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)
prob(SWB=5)	0.001**	0.001*	0.001*	0.001**	0.001*	0.001*
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)

prob(SWB=6)	0.0003**	0.0003*	0.0003*	0.0003**	0.0003*	0.0003*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
prob(SWB=7)	0.0002*	0.0001*	0.0001*	0.0002**	0.0001*	0.0001*
	(0.0001)	(0.0001)	(0.0001)	(0.00007)	(0.00007)	(0.00008)
Household composition	No	No	Yes	No	No	Yes
Round dummy	No	No	Yes	No	No	Yes
Observations	1,530	1,530	1,530	1,530	1,530	1,530
Number of households	550	550	550	550	550	550

Note: Panel (a) reports the effects of IBLI uptake and volume of TLUs insured on vignette adjusted SWB relative to Borana pastoralists in log-odds units. Panel (b) reports the marginal effects for the main results in panel (a) IBLI/ TLUs insured, lapsed IBLI/ TLUs insured and number of TLUs owned. The marginal effects estimates in panel (b) show the effects of these variables on the probability of reporting one of the seven unique scales of SWB. In column 3 for example, IBLI uptake reduces the probability of reporting SWB=1 by 4.9% and increases the probability of reporting SWB=7 by 1.7%. A unit increase in TLUs owned reduces the probability of reporting SWB=1 by 0.4% and increases the probability of reporting SWB=7 by 0.1%. TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A13: Ordered Logit Regression: Estimates for Raw SWB Using IBLI Uptake and Volume of TLUs Insured

	IBLI uptake			TLUs insured		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: SWB	panel (a)					
Predicted IBLI/TLUs insured	0.759***	0.597**	0.646**	0.126***	0.128***	0.126***
	(0.250)	(0.238)	(0.282)	(0.041)	(0.041)	(0.034)
Predicted lapsed IBLI/TLUs	-0.724***	-0.734***	-0.730***	-0.136***	-0.133***	-0.135***
	(0.223)	(0.230)	(0.233)	(0.033)	(0.034)	(0.022)
Number of TLUs owned	0.034***	0.030***	0.029***	0.034***	0.030***	0.029***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.004)
Asset index		0.205**	0.187**		0.231***	0.213***
		(0.086)	(0.089)		(0.080)	(0.055)
Annual income (‘000 Birr)		0.003	0.002		0.003	0.002
		(0.003)	(0.003)		(0.003)	(0.002)
Household head gender						
(Male=1)			0.406**			0.346***
			(0.191)			(0.131)
Household head age			0.023			0.025
			(0.021)			(0.020)
Household head age squared			-0.0002			-0.0003
			(0.0002)			(0.0003)
Household size			-0.066			-0.051

			(0.055)			(0.043)
Household head schooling			-0.019			-0.017
			(0.032)			(0.024)
			panel (b)			
Predicted IBLI/TLUs insured						
prob(SWB=1)	-0.051***	-0.040**	-0.043**	-0.008***	-0.009***	-0.008***
	(0.017)	(0.016)	(0.018)	(0.003)	(0.003)	(0.003)
prob(SWB=2)	-0.077***	-0.060**	-0.064**	-0.013***	-0.013***	-0.013***
	(0.026)	(0.025)	(0.027)	(0.004)	(0.004)	(0.004)
prob(SWB=3)	-0.003	-0.002	-0.003	-0.0005	-0.0003	-0.0005
	(0.006)	(0.005)	(0.005)	(0.001)	(0.001)	(0.001)
prob(SWB=4)	0.098***	0.077**	0.083**	0.016***	0.016***	0.016***
	(0.033)	(0.031)	(0.034)	(0.005)	(0.005)	(0.005)
prob(SWB=5)	0.032***	0.025**	0.027**	0.005***	0.005***	0.005***
	(0.011)	(0.010)	(0.011)	(0.002)	(0.002)	(0.002)
Predicted lapsed IBLI/TLUs insured						
prob(SWB=1)	0.048***	0.049***	0.048***	0.009***	0.009***	0.009***
	(0.015)	(0.016)	(0.016)	(0.002)	(0.002)	(0.002)
prob(SWB=2)	0.073***	0.074***	0.073***	0.014***	0.013***	0.013***
	(0.023)	(0.024)	(0.024)	(0.003)	(0.003)	(0.003)
prob(SWB=3)	0.003	0.002	0.003	0.0005	0.0004	0.0005
	(0.006)	(0.006)	(0.006)	(0.001)	(0.001)	(0.001)

prob(SWB=4)	-0.094***	-0.094***	-0.093***	-0.017***	-0.017***	-0.017***
	(0.030)	(0.030)	(0.030)	(0.004)	(0.004)	(0.004)
prob(SWB=5)	-0.031***	-0.031***	-0.031***	-0.006***	-0.006***	-0.006***
	(0.010)	(0.010)	(0.010)	(0.002)	(0.002)	(0.002)
Number of TLUs owned						
prob(SWB=1)	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
prob(SWB=2)	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
prob(SWB=3)	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
prob(SWB=4)	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
prob(SWB=5)	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0003)
Household composition	No	No	Yes	No	No	Yes
Round dummy	No	No	Yes	No	No	Yes
Observations	1,530	1,530	1,530	1,530	1,530	1,530
Number of households	550	550	550	550	550	550

Note: Panel (a) reports the effects of IBLI uptake and volume of TLUs insured on raw (unadjusted) SWB in log-odds units. Panel (b) reports the marginal effects for the main results in panel (a) IBLI/ TLUs insured, lapsed IBLI/ TLUs insured and number of TLUs owned. The marginal effects estimates in panel (b) show the effects of these variables on the probability of reporting one of the five unique scales of SWB. In column 3, IBLI uptake reduces the probability of reporting SWB=1 by 4.3% and increases the

probability of reporting SWB=5 by 2.7%. In column 6, unit increase in the number of TLUs insured reduces the probability of reporting SWB=1 by 0.8% and increases the probability of reporting SWB=5 by 0.5%. TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A14: Ordered Logit Regression: Vignette Adjusted SWB Estimates Using IBLI Uptake and TLUs Insured – Panel Households Only

	IBLI uptake			TLUs insured		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: SWB	panel (a)					
Predicted IBLI/TLUs insured	0.921***	0.799***	0.944***	0.143***	0.145***	0.154***
	(0.274)	(0.269)	(0.300)	(0.041)	(0.040)	(0.042)
Predicted lapsed IBLI/TLUs	-0.486**	-0.449**	-0.452**	-0.074**	-0.066**	-0.068**
	(0.203)	(0.190)	(0.190)	(0.031)	(0.031)	(0.031)
Number of TLUs owned	0.013	0.010	0.009	0.014*	0.009	0.009
	(0.008)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)
Asset index		0.237*	0.186		0.315***	0.280***
		(0.129)	(0.135)		(0.110)	(0.106)
Annual income (‘000 Birr)		0.004*	0.004*		0.004*	0.004*
		(0.003)	(0.003)		(0.003)	(0.003)
Household head gender						
(Male=1)			0.801**			0.663**
			(0.372)			(0.335)
Household head age			-0.049			-0.047
			(0.042)			(0.038)
Household head age squared			0.0005			0.0004
			(0.0004)			(0.0003)
Household size			-0.208**			-0.173**

			(0.093)			(0.086)
Household head schooling			0.034			0.034
			(0.059)			(0.062)
			panel (b)			
Predicted IBLI/TLUs insured						
prob(SWB=1)	-0.045***	-0.039***	-0.046***	-0.007***	-0.007***	-0.007***
	(0.014)	(0.014)	(0.015)	(0.002)	(0.002)	(0.002)
prob(SWB=2)	-0.038***	-0.032***	-0.039***	-0.006***	-0.006***	-0.006***
	(0.011)	(0.011)	(0.012)	(0.002)	(0.002)	(0.002)
prob(SWB=3)	-0.030***	-0.026***	-0.031***	-0.005***	-0.005***	-0.005***
	(0.009)	(0.009)	(0.010)	(0.002)	(0.002)	(0.002)
prob(SWB=4)	0.006**	0.005*	0.007**	0.001*	0.001*	0.001*
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
prob(SWB=5)	0.060***	0.051***	0.062***	0.009***	0.009***	0.010***
	(0.018)	(0.018)	(0.019)	(0.003)	(0.003)	(0.003)
prob(SWB=6)	0.029***	0.025***	0.030***	0.005***	0.005***	0.005***
	(0.009)	(0.008)	(0.009)	(0.001)	(0.001)	(0.001)
prob(SWB=7)	0.018***	0.015***	0.018***	0.003***	0.003***	0.003***
	(0.005)	(0.005)	(0.006)	(0.001)	(0.001)	(0.001)
Predicted lapsed IBLI/TLUs insured						
prob(SWB=1)	0.024**	0.022**	0.022**	0.004**	0.003**	0.003**
	(0.009)	(0.009)	(0.009)	(0.002)	(0.002)	(0.002)

prob(SWB=2)	0.020***	0.018**	0.018**	0.003**	0.003**	0.003**
	(0.008)	(0.008)	(0.008)	(0.001)	(0.001)	(0.001)
prob(SWB=3)	0.016**	0.014**	0.015**	0.002**	0.002*	0.002**
	(0.006)	(0.006)	(0.006)	(0.001)	(0.001)	(0.001)
prob(SWB=4)	-0.003*	-0.003*	-0.003*	-0.0005	-0.0004	-0.0005
	(0.002)	(0.002)	(0.002)	(0.0003)	(0.0003)	(0.0003)
prob(SWB=5)	-0.032***	-0.029**	-0.029**	-0.005**	-0.004**	-0.004**
	(0.012)	(0.012)	(0.012)	(0.002)	(0.002)	(0.002)
prob(SWB=6)	-0.016***	-0.014**	-0.014**	-0.002**	-0.002**	-0.002**
	(0.006)	(0.006)	(0.006)	(0.001)	(0.001)	(0.001)
prob(SWB=7)	-0.009***	-0.009**	-0.008**	-0.001**	-0.001**	-0.001**
	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)
Number of TLUs owned						
prob(SWB=1)	-0.001	-0.0005	-0.0005	-0.001*	-0.0004	-0.0005
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
prob(SWB=2)	-0.001	-0.0004	-0.0004	-0.001*	-0.0004	-0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
prob(SWB=3)	-0.0004	-0.0003	-0.0003	-0.0004	-0.0003	-0.0003
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
prob(SWB=4)	0.00008	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.00007)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
prob(SWB=5)	0.001	0.001	0.001	0.001*	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

prob(SWB=6)	0.0004	0.0003	0.0003	0.0004*	0.0003	0.0003
	(0.0003)	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)
prob(SWB=7)	0.0002	0.0002	0.0002	0.0003*	0.0002	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Household composition	No	No	Yes	No	No	Yes
Round dummy	No	No	Yes	No	No	Yes
Observations	1,530	1,530	1,530	1,530	1,530	1,530
Number of households	550	550	550	550	550	550

Note: Panel (a) reports the effects of IBLI uptake and volume of TLUs insured on vignette adjusted SWB in log-odds units. Panel (b) reports the marginal effects for the main results in panel (a) IBLI/ TLUs insured, lapsed IBLI/ TLUs insured and number of TLUs owned. The marginal effects estimates in panel (b) show the effects of these variables on the probability of reporting one of the seven unique scales of SWB. In column 3 for example, IBLI uptake reduces the probability of reporting SWB=1 by 4.6% and increases the probability of reporting SWB=7 by 1.8%. In column 6, a unit increase in the number of TLUs insured reduces the probability of reporting SWB=1 by 0.7% and increases the probability of reporting SWB=7 by 0.3%. TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Attrition

In this article, we use three rounds of panel data. However, there was attrition of sample households in each survey round. If the sample households who dropped out differ systematically from those who remained in the sample, inference becomes difficult due to attrition bias. In this section, we test if households who dropped out of the sample introduce attrition bias into our estimates. We find that they do not.

Between the baseline and second round survey 40 (about 8% of the sample) households dropped out, and in round three an additional 10 households (2% of sample) dropped out. Yet in round three, 10 of the 40 households who dropped out in round two returned and were re-interviewed. Following Fitzgerald, Gottschalk, and Moffitt (1998), we first check if attrition is random by estimating attrition probit equations for our outcome variables – IBLI uptake and SWB. Then, if attrition is found to be non-random, we make attrition bias correction to our estimates in Tables 4 and 5.

We estimate the equations:

$$pr(A_{ivt} = 1) = \tau_0 + \tau_1 IBLI_{ivt-1} + \tau_2 X_{ivt} + \tau_3 Z_{ivt} + \psi_i + e_{ivt} \quad \text{(A1)}$$

and

$$pr(A_{ivt} = 1) = \tau'_0 + \tau'_1 SWB_{ivt-1} + \tau'_2 X_{ivt} + \tau'_3 Z_{ivt} + \psi'_i + e'_{ivt} \quad \text{(A2)}$$

where, A is an attrition dummy variable that takes value one if a households attrites in any survey rounds or zero otherwise; X is a vector of household demographic characteristics, household composition, household income and wealth variables, Z is a vector of auxiliary variables that affect attrition including discount and information treatments, group membership dummies, and

exposure to various shocks. The right-hand side variables also include lagged IBLI uptake and SWB.

Table A15 presents probit estimates of the probability of attrition with lagged IBLI and SWB equations. Column 1 shows that all coefficients are individually insignificant, suggesting that attrition is random. Wald joint test of the group (auxiliary) variables (Chi-squared statistic of 26.08 with 24 degrees of freedom and p-value of 0.297) indicates that these variables are not jointly statistically significantly different from zero. Similarly, column two shows that all of the explanatory variables are statistically insignificant, except for the discount coupon in sales period one, which is significant only at the 10% level. These results also suggest attrition is random. The resulting Chi-squared statistic of a joint Wald test of the group variables and discount coupon in sales period one of 26.37 with 24 degrees of freedom and p-value of 0.335 indicates attrition is random. This leads us to conclude that our estimates of IBLI participation and the effect of IBLI on SWB are likely free of attrition bias, and that no attrition correction is required.

Table A15: Attrition Probit Estimates

	Attrition on IBLI status	Attrition on SWB
Dependent variable: Attrition indicator	(1)	(2)
$IBLI_{t-1}$	1.193	
	(0.794)	
SWB_{t-1}		0.142
		(0.102)
Discount: SP1 only	-0.843	-0.759*
	(0.529)	(0.459)
Discount: SP2 only	-0.660	-0.744
	(0.791)	(0.688)
Value of discount (%) SP1	-0.893	-0.826
	(1.071)	(0.835)
Value of discount (%) SP2	-0.344	0.041
	(1.142)	(1.343)
Comic book: SP1 only	0.131	0.157
	(0.411)	(0.436)
Household head gender (Male=1)	-0.303	-0.380
	(0.307)	(0.302)
Household head age	-0.007	-0.013
	(0.048)	(0.041)
Household age squared	-0.000	0.000

	(0.000)	(0.000)
Household size	-0.312	-0.327
	(0.431)	(0.453)
Household head highest grade	-0.151	-0.119
	(0.156)	(0.079)
Number of female household members	-0.023	-0.034
	(0.110)	(0.111)
Number of household members under 5	0.286	0.327
	(0.466)	(0.461)
Number of household members between 5 and 15	0.268	0.276
	(0.423)	(0.458)
Number of household members between 15 and 64	0.301	0.319
	(0.407)	(0.452)
Number of TLUs owned	0.002	0.001
	(0.007)	(0.008)
Asset index	-0.026	-0.041
	(0.199)	(0.229)
Annual income (‘000 Birr)	0.005	0.003
	(0.010)	(0.007)
Net transfers (‘000 Birr)	-0.016	-0.013
	(0.046)	(0.038)
If household head is village water point group	-0.261	-0.331
	(0.536)	(0.464)

If household head is village pasture group	0.080	0.130
	(0.451)	(0.399)
If household head is a member of *Iqub*	0.717	0.612
	(0.598)	(0.511)
Animal sickness or death	-0.022	-0.003
	(0.281)	(0.254)
Animal loss or theft	0.192	0.172
	(0.307)	(0.286)
Insecurity/Violence/Fights	0.310	0.278
	(0.286)	(0.227)
Human sickness	-0.103	-0.091
	(0.274)	(0.223)
Low prices for animals one wishes to sell	0.159	0.129
	(0.235)	(0.234)
Crop disease	-0.067	-0.128
	(0.178)	(0.198)
Lack of food	-0.121	-0.044
	(0.456)	(0.464)
High food prices	0.085	-0.039
	(0.404)	(0.394)
Land scarcity/disputes	-0.084	-0.022
	(0.267)	(0.242)
Lack of employment opportunities	-0.519	-0.544

	(0.353)	(0.342)
Flood damage	0.032	0.022
	(0.327)	(0.385)
Constant	-0.094	-0.208
	(1.321)	(1.197)
Observations	1,012	1,012
Number of groups (households)	538	538

Note: This table presents the probit attrition probability estimates as function of lagged IBLI and SWB. SP stands for sales period; TLU stands for tropical livestock units. Cluster bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.