Insuring Wellbeing? 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. By exploiting randomization of incentives to purchase index-based livestock insurance and three rounds of panel data in southern Ethiopia, we separately identify prospective (*ex ante*) welfare gains from reduced exposure to risk, and retrospective (*ex post*) buyer's remorse effects after resolution of uncertainty. We find that current coverage generates gains in SWB that are significantly higher than the buyer's remorse effect of insurance that didn't pay out. Failure to control for potential buyer's remorse effects can bias estimates of welfare gains from insurance downwards.

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1. Introduction

Uninsured risk exposure and the experience of uninsured shocks in low-income rural communities are widely believed to cause serious welfare losses and to distort behaviors, potentially even resulting in poverty traps (Rosenzweig and Binswanger 1993; Morduch 1994; Dercon 2005; Carter and Barrett 2006; Dercon and Christiaensen 2011; Barrett and Carter 2013). Standard insurance products are routinely unavailable, however, due to moral hazard and adverse selection problems, as well as high transaction costs in infrastructure-poor areas (Besley 1995). In response to the lack of available, 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 costs 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.

But there is little empirical evidence demonstrating that index insurance generates welfare gains for poor, rural households.[2] Indeed, the low uptake of index insurance products introduced across a range of countries over the last several years hints that perhaps many prospective buyers believe index insurance does not deliver welfare gains (Giné, Townsend, and Vickery 2008; Binswanger-Mkhize 2012; Cole et al. 2013).[3] Indeed, index insurance uptake may even cause welfare losses for buyers for at least two reasons. First, high commercial loadings by insurers can drive premium rates well above actuarially fair levels. Second, when the index does not closely track policyholder's 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

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[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.

[2] Karlan et al. (2014), Jensen, Barrett, and Mude (2014a, 2014b) and Janzen and Carter (2013) 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, 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.

despite a premium payment; as a result, index insurance will not stochastically dominate remaining uninsured (Jensen, Barrett, and Mude 2014a).

One complication in estimating the welfare effects of insurance coverage is that the prospective (*ex ante*) and retrospective (*ex post*) well-being effects of risk management behaviors may differ. Indeed *ex post* effects likely differ considerably from *ex ante* assessments based on whether the insured receives an indemnity payment or not. Insurance may be *ex ante* welfare enhancing for risk averse agents prior to the realization of stochastic events that may impose substantial losses. Yet the same insurance may prove *ex post* welfare reducing once the risk has passed, especially if the coverage period ends without an indemnity payout. In this case, the purchaser has "lost" her premium and, with the benefit of perfect hindsight, recognizes that she would have been unambiguously better off financially had she not bought insurance coverage after all. The possibility of such buyer's remorse can confound valuation of insurance coverage. For example, if one cannot both control for household-specific unobservables that affect valuation and distinguish between periods of active insurance coverage and periods when insurance coverage has lapsed, then any positive correlation in insurance demand across periods not fully controlled for with other covariates may lead to biased estimates of the *ex ante* value of insurance coverage, with downward bias following periods without indemnity payments, when insurance purchase lost the insuree money.

In this paper we take a novel approach to estimating the impact of insurance on a poor, rural population, exploring whether index insurance coverage improves subjective well-being (SWB). 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, Dequiedt, and Sadoulet 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 (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 and policy evaluation (Frey and

Stutzer 2001; Clark 2003; Fafchamps and Shilpi 2008; Graham 2009; Ravallion, Himelein, and Beegle 2013; Kaminski 2014; Krueger and Stone 2014).

Several features of our data enable us to disentangle the *ex ante* and *ex post* SWB effects of index insurance. First, we exploit the randomization of incentives to purchase an index-based livestock insurance (IBLI) product newly introduced in southern Ethiopia by a commercial underwriter in August 2012. The project's experimental design enables us to control for prospective selection effects in IBLI uptake using instrumental variables methods. Meanwhile, the novelty of the product obviates the prospective confounding of past, unobserved experience with IBLI on buyers' reported SWB. Second, we use three years' repeated observations of the same households, which enable us to use household fixed effects to control for time-invariant unobservables that might affect IBLI valuation. We then identify the causal effect of IBLI uptake on SWB by exploiting the considerable intertemporal variation in households' IBLI uptake, using 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. Third, during our study period, IBLI did not pay out.[4] Therefore, any *ex post* effects would be exclusively buyer's remorse as purchasers were left unambiguously worse off in financial terms from having paid a premium for a policy that returned no indemnity payment(s).

The key findings are that current IBLI coverage – represented by both a discrete measure of uptake and by a continuous measure of purchase volume – generates statistically significant SWB gains that significantly exceed the statistically significant adverse buyer's remorse effects. Our results are robust to a host 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. We also show that the estimated SWB gains from insurance are downwardly biased if one omits control for lapsed insurance coverage that generates buyer's remorse. The clear implication is that IBLI improves buyers' SWB even over a period when insurance buyers lose money on the policy. This result is intuitive. Few (if any) of us feel worse off at the end of an insurance coverage period when we have not suffered hospitalization, a house fire or a vehicular accident even though we recognize that we lost money on our health, home or automobile

[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.

insurance policy. The *ex ante* peace of mind effect dominates any *ex post* buyer's remorse we might feel. Pastoralists in southern Ethiopia exhibit similar sentiments. Even an insurance policy that does not pay out still improves people's perceptions of their well-being.

The remainder of the paper is organized as follows. The next section presents the study setting and discusses IBLI and its contract design. Section 3 discusses the sampling and experimental design and reports summary statistics of the data. Section 4 details our vignette correction strategy, following best current practice in the SWB literature. Section 5 presents our two-stage estimation strategy. Section 6 reports our main results. Section 7 presents a range of robustness checks. Section 8 concludes.

2. Study setting and IBLI

The Borana zone of Oromia region, Ethiopia, is a vast pastoralist land mass consisting mainly of arid and semi-arid agro-ecological zones with a bimodal rainfall pattern. 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).

In our sample, which covers eight *woredas*[5] of Borana zone (Figure A1), livelihood strategies are changing rapidly. Indeed, some households' traditional migratory pastoralism strategy has collapsed. There are widespread concerns that more frequent drought, perhaps associated with climate change, is making pastoralism a more tenuous enterprise (Barrett and Santos 2014). As a result, indigenous social insurance mechanisms have declined. Further, much of the risk that pastoralists face is covariate, in the sense that the community collectively experiences the same drought. Informal community networks, therefore, cannot sufficiently mitigate the effects of shocks (Lybbert et al. 2004; Santos and Barrett 2011).

All of these suggest that formal insurance might effectively transfer drought risk out of the system to underwriters in the national capital, Addis Ababa, or to international reinsurers, 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

[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.

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).

Index-based livestock insurance (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 (Chantarat et al. 2013), 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). During the 2011 Horn of Africa drought, IBLI worked as designed, attracting praise from governments, humanitarian response agencies and communities in the region. Following the 2011 drought, an Ethiopian firm, Oromia Insurance Company (OIC), decided to develop and pilot a locally adapted variant of IBLI for Ethiopian pastoralists in Borana zone, which is 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 premium rates are applied to the value of herd that an IBLI buyer chooses to insure in order to establish the total amount that must paid for IBLI coverage.

There are four seasons in Borana: long rainy (March-May), long dry (June-September), short rainy (October-November), and short dry (December-February) seasons. IBLI insurance contracts are sold during two sales periods (SP) – January-February and August-September – prior to the start of the short and long rainy seasons. Contracts cover a full 12-month period. For example, the coverage of a contract sold in January 2014 spanned March 2014 – February 2015, while one sold in August 2013 covered October 2013 – September 2014. Households can augment coverage from one SP to the next. Index readings for each sales period are announced and indemnity payments

[6] For a more detailed discussion of the construction of the IBLI Borana index, see (ILRI-IBLI 2013).

made to policyholders, if the contractually stipulated strike rate is triggered, at the end the season (Figure 1).

As with all index insurance, 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, Barrett, and Mude 2014a; 2014b). 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.

Recent impact evaluations of the original IBLI pilot in northern Kenya nonetheless find income and productivity gains, on average, for IBLI policyholders (Jensen, Barrett, and Mude 2014a; 2014b). But in that setting, significant indemnity payouts had occurred in just 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 2013). Because there were no indemnity payments in the sample we study, the southern Ethiopia case offers the chance to isolate 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 purchasers' 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.

3. Data

A baseline survey (round 1, R1) was designed and fielded in February-March 2012 before IBLI was developed or announced; no survey respondents had yet been exposed to training or marketing of IBLI. After the baseline, in August-September 2012 (sales period 1, SP1), the first IBLI contracts, which cover a 12 months period between October 2012 – September 2013, were sold to pastoralists in the study area. In January-February 2013 (SP2), the March 2013-February 2014 contracts were offered, followed by a follow-up survey round (R2) of the original sample households in March-April 2013. Contract sales were repeated in August-September 2013 (SP3) and January-February 2014 (SP4). A third round (R3) survey was then conducted in March 2014 among 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) among the same respondents when IBLI contracts were in force and one round (R3) when SP1 and SP2 contracts had lapsed. The panel allows us to control for time-invariant household unobservable characteristics that might affect both SWB and IBLI uptake. The experimental design (described below) permits us to control for inevitable selection effects in the voluntary purchase of IBLI. As no indemnity payments occurred during this period, 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 prospective *ex post* buyer's remorse effects.

Sampling was clustered at the *reera*[7] level. *Reera*s were purposively selected based on availability of population lists collected for other Borana surveys in 2011. Inaccessible *reera*s were excluded for logistical reasons. New study sites were added to maximize geographic distribution, variation in market access, and agro-ecological variation across the eight *woreda*s of Borana *zone* in our sample (ILRI 2014). In the selected *reera*s, sample households were randomly selected from the population lists. In each *reera*, households were grouped into three livestock holding – measured in tropical livestock units (TLU) [8] – classes, from the richest to the poorest tercile. A tercile-balanced stratified sample of households was randomly drawn such that in each *reera* a sample of 15 percent of households would be drawn on the condition that a minimum of 25 households are selected. When this condition was not satisfied in a *reera*, neighboring *reera*s were combined to form a bigger study site, resulting in a total of 17 study sites distributed across eight *woreda*s (ILRI 2014).

The survey collected data on a broad range of household characteristics, livestock and other assets, livelihood activities, consumption, social networks, expectations and subjective well-being from a baseline sample of 515 households, of which 476 were re-interviewed in R2. In R2, in addition to the 476 households surveyed in R1, 32 new replacement households were surveyed from the original population lists. Replacement households were chosen from the same study site and TLU class as the households they replaced. If replacements could not be found in the same TLU class, households in the adjacent TLU class were picked. Out of the 508 households surveyed in R2, 500

[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, sometimes referred to collectively as 'shoats'.

were re-surveyed in R3, and an additional 14 replacements were also interviewed. In R3 attempts were made to re-interview households who were sampled in R1 but missed in R2. As a result, out of the 14 replacements, 10 were original R1 households and 4 were new households. Over the three data rounds, a total of 551 unique households – 515 original households, 32 replacements in R2, and 4 new replacements in R3 – were surveyed. Seven households had missing SWB measures or key independent variables and, thus, were dropped from the sample, leaving a final estimation sample of 1,530 observations (515 in R1, 504 in R2 and 511 in R3) and 550 unique households, consisting of 465 households who were surveyed in all three rounds, 50 households surveyed in two rounds (8 in R1 and R2, 12 in R1 and R3, and 30 in R2 and R3), and 35 households surveyed only once.[9] Following the launch of IBLI, in R2 and R3 the survey also included a module of IBLI uptake and awareness.

To encourage IBLI uptake while also providing experimental treatments that could be used to identify the impacts of IBLI uptake rigorously, several combinations of three encouragement designs were randomly implemented in each of the IBLI sales periods. These included information dissemination through (i) audio tapes of a poem or (ii) comic books and (iii) distribution of premium discount coupons prior to all IBLI sales periods (Table 1). In each sales period, between 42 and 57 percent of survey households were randomly assigned a discount coupon that would allow them to purchase IBLI for up to 15 cattle (or equivalent value of other livestock species) at a discount below the unsubsidized policy premium. In each sales period, 7 to 10 randomly selected households received IBLI at a 100% discount as part of a sub-experiment unrelated to this paper. The rest of the discount coupon recipients were evenly distributed across discount levels of 10%, 20%, 30%, 40%, 50%, 60%, 70%, and 80%.[10] This created exogenous variation in the effective price faced by prospective buyers, and generated a randomized discrete reminder – the physical coupon – of the option to buy IBLI, thereby providing a plausible instrument for IBLI purchase decisions.

All communities received a basic briefing that described the IBLI product before each sales period. One of two additional randomized IBLI information treatments – through comic books or via audio tapes of a poem about IBLI recited in the local language, Oromiffa, by its author – was delivered

[9] A detailed treatment of potential attrition bias in the data and relevant corrections is presented in the online Appendix.
[10] In each sales period about 4-6 percent of sample households were assigned to each discount class/level.

to sub-samples of respondents in SP1 and SP2.[11] The two information treatments – comic book and audio tape – were randomized among 12 of the 17 study sites, with no overlap in assignment. Within the sites selected for information treatment, a control group received no additional extension messages about IBLI. The randomized assignment of households into extension treatments and discount coupons with varying discount levels was implemented independently for each sales period. During the subsequent semi-annual sales periods, insurance was then offered and households chose whether to purchase IBLI coverage and, if so, how many TLUs to insure.

Among our final sample households, in SP1 and SP2 42 percent of households received discount coupons, whereas 16 percent and 9 percent of households received comic book and audio tape information treatments (Table 2). In SP1, 212 households received discount coupons, of which 56 households also received comic book extension and 34 households received audio tape extension. A total of 79 households received additional information about IBLI via comic books and 41 households via audio tape. 172 households did not receive any treatment. In SP2, 211, 84, and 44 households were given discount coupon, comic book, and poet tape encouragement treatments, respectively. 53 households received discount coupon and comic book, and 25 households received discount coupon and audio tape treatments. The information extension treatments were dropped in subsequent sales periods, and 288 (57 percent of the sample) and 256 (51 percent of the sample) households received discount coupons in SP3 and SP4, respectively.

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 (SP1/SP3) than in the August-September sales period (SP1/SP3). Of the 504 households surveyed in R2, 130 purchased IBLI in SP1 and 94 in SP2. Similarly, of the 514 households surveyed in R3, 150 purchased IBLI in SP3, but only 62 in SP4. This difference

[11] 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 Oromiffa to a randomly selected sub-sample of respondents (for more detail see ILRI 2014).

might arise due to seasonality in household liquidity.[12] Or this may simply reflect the initial launch of IBLI in August-September that set an arbitrary seasonal schedule that subsequently persists.

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 SP1, 23 buyers augmented coverage further by buying additional policies in SP2, 53 allowed their policy to lapse after a year, and 77 extended their coverage in SP3.. The remaining 71 buyers in SP2 were first time buyers. Likewise, 73 of the 94 IBLI buyers in SP2 allowed their contracts to lapse and 21 renewed their contract in SP4. Among the 150 households who bought IBLI policies in SP3, 33 households bought additional coverage in SP4. 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.

Table 2 reports summary statistics on key dependent and independent variables used in the study by insurance (columns 2-4) and treatment status (columns 5-7)[13]. In columns 2-4, 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.[14] Similarly, 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.

[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).

[13] Appendix Table A2 provides detailed variable definitions. In Table 2, columns 2-4 present the averages of the variables in R2 and R3, during which IBLI was available for purchase. Columns 5-7 show the baseline (R1) averages of the variables for households who were re-interviewed in R2 and/or R3.

[14] Since survey rounds 2 and 3 were preceded by two sales periods each, a household who purchased IBLI in SP2 but had received discount coupon in SP1 is reported to have received discount coupon for the survey round, hence the slightly higher figures in Table 2.

Insured and uninsured households are not distinguishable by observable characteristics, with the exception of 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 various social groups vary insignificantly between those that purchased insurance and those who did not. This, however, does not rule out potential differences based on unobservable characteristics. So long as such 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 therefore exploit the random assignment of treatments to address these concerns.

Columns 5-7 report pre-treatment balance in the experimental design. 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 successful. The discount coupon and information treatments, each strongly correlated with IBLI uptake, were indeed randomly assigned by any of the dependent or independent variables we use. 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 A5). Joint significance tests from the linear probability regression of treatment dummies (discount coupon, audio tape and comic book) for each sales period 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 those regressions. The only exception is the audio tape treatment in the August-September 2012 sales period (SP1), for which we fail to reject the null of jointly significant regressors at the five percent significance level.[15]

[15] The joint significance test also fails to reject the null of jointly significant independent variables for selection into discount coupons in SP1 at 10 percent significance level. However, this result is mainly due to "expected TLU loss" and "annual income" variables, whose coefficient estimates change sign in subsequent sales periods, suggesting that their statistical significance in the SP1 equation could be due just to random chance.

4. SWB and Vignette correction

Subjective measures of welfare are becoming increasingly popular but pose methodological challenges (Krueger and Schkade 2008). First, respondents may have different reference points when answering a subjective question, making interpersonal comparisons problematic. Second, responses may not be stable across questions within a survey. 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 all respondents' comparisons in order to bring objective and subjective assessments into alignment (Van Soest et al. 2011; Krueger and Stone 2014).[16]

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, Himelein, and Ravallion 2012; Ravallion, Himelein, and Beegle 2013).

King et al. (2004), King and Wand (2007) and Van Soest et al. (2011) suggest an approach for correcting latent heterogeneity problems that involves measuring the interpersonal incomparability of responses itself. 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

[16] 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.

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 SWB measures as reported by respondents, 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[17]

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

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 localsocio-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 and 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 Tables A3 and A4 show that vignette corrected SWB measures largely mirror SWB, particularly at the lower end of the scale. For example, 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 these data, vignette correction appears to

[17] 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.

shift the mass of observations from the middle of the distribution to the upper half, generating a more even distribution (Figures A2-A3).

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 above, 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 2012).

5. 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. Indeed, IBLI uptake is very likely endogenous. In other words, 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 extension treatments and randomized distribution of premium discount coupons, allow us to address the selection bias associated with insurance uptake choices. By first estimating selection into IBLI using randomized encouragement treatments as instrumental variables and then estimating the effect of instrumented IBLI on SWB, we can derive unbiased and consistent causal estimates of IBLI's impact on SWB.

IBLI uptake by household i in village v at time t, is estimated using the linear probability model (LPM)[18] as:

$$Pr(IBLI_{ivt} = 1) = \omega + \phi_1 D_{iv1t} + \phi_2 D_{iv2t} + \phi_3 D_{iv(12)t} + \rho_1 A_{iv1t} + \rho_2 A_{iv2t} + \rho_3 A_{iv(12)t} + \rho_4 C_{iv1t} + \rho_5 C_{iv2t} + \rho_6 C_{iv(12)t} + \mu_1 P_{iv1t} + \mu_2 P_{iv2t} + \zeta X_{ivt} + \tau_i + \psi_{ivt} \quad (2)$$

[18] When used to predict an endogenous dichotomous variable in the first stage of an instrumental variables (IV) regression, LPM does not suffer from the "forbidden regression" problem associated with non-linear models such as logit or probit (Angrist and Pischke 2008; Wooldridge 2010).

The randomly assigned treatments include dummy variables for receiving a randomly assigned premium discount coupon (C) 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). 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, that may influence the uptake of IBLI are included as controls, including household herd size and income, 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, are also included.

When applied to R2 data, we predict current uptake, $\widehat{IBLI_{\iota v2}}$, using equation (2) based on purchases in SP1 and SP2. There were no lapsed contracts in R2. When applied to R3 data, we predict current uptake, $\widehat{IBLI_{\iota v3}}$, based on purchases in SP3 and SP4, and use the $\widehat{IBLI_{\iota v2}}$ predicted value to capture lapsed contracts.

By using the randomized coupon distribution and extension treatments to instrument for the purchase of IBLI coverage in the first stage estimation above, we can estimate the causal effect of IBLI on SWB in the second stage of our estimation. The second stage ordered logit regression includes predicted IBLI uptake, number of TLUs owned (TLU), predicted lapsed IBLI uptake – the probability of having acquired an IBLI contract that has lapsed, a series of controls and household FE, γ:

$$SWB_{ivt} = \alpha + \beta\, \widehat{IBLI}_{ivt} + \theta\, TLU_{ivt} + \pi\, \widehat{IBLI\_Lapsed}_{ivt} + \delta` X_{ivt} + \gamma_i + \varepsilon_{ivt} \qquad (3)$$

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 $\widehat{IBLI\_Lapsed}_{ivt}$, $\hat{\pi}$, 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 (3) 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 (2) replacing the IBLI variable in equation (3) with quantity of TLUs insured. The first stage uptake equation for the negative censored continuous variable *TLU_insured* is estimated using Tobit as:

$$TLU\_Insured_{ivt} = \omega' + \phi'_1 D_{iv1t} + \phi'_2 D_{iv2t} + \phi'_3 D_{iv(12)t} + \rho'_1 A_{iv1t} + \rho'_2 A_{iv2t} + \rho'_3 A_{iv(12)t} + \rho'_4 C_{iv1t} + \rho'_5 C_{iv2t} + \rho'_6 C_{iv(12)t} + \mu'_1 P_{iv1t} + \mu'_2 P_{iv2t} + \zeta' X_{ivt} + \tau'_i + \psi'_{ivt}. \tag{4}$$

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 on SWB of buying an additional TLU of IBLI coverage:

$$SWB_{ivt} = \alpha' + \beta' \widehat{TLU\_ins}_{ivt} + \theta' TLU_{ivt} + \pi' \widehat{TLU\_Lapsed}_{ivt} + \delta'` X_{ivt} + \gamma'_i + \varepsilon'_{ivt} \tag{5}$$

Estimated standard errors are clustered at the village (*reera*) level in all regressions.

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, $\widehat{\beta'}$, multiplied by the number of TLUs insured net of the coefficient on instrumented lapsed TLU insured, π', multiplied by the number of lapsed TLUs insured, ($\beta' \widehat{TLU\_ins}_t + \pi' \widehat{TLU\_Lapsed}_t$). 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 ($\widehat{\beta'} > 0$). Conversely, if the basis risk on the product is high such that IBLI is more like a lottery ticket than a conventional indemnity insurance policy, IBLI could increase stress and reduce SWB ($\hat{\beta} < 0$). For the same reason, greater IBLI coverage may cause higher stress and lower SWB ($\widehat{\beta'} < 0$).

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 2001; Graham 2009), 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 (TLU), $\widehat{\theta'}$, multiplied by the net flow of funds associated with the period-specific net indemnity payments (indemnity payments minus premium payments) associated with the predicted IBLI uptake volume, converted into TLU units at prevailing livestock prices, *NI*.[19]

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

$$\Delta\widehat{SWB}_{ivt} = \widehat{\beta}'\, T\widehat{LU\_In}s_{ivt} + \hat{\pi}\,'TLU\_\widehat{Lapse}d_{ivt} + \hat{\theta}\, NI_{ivt} \tag{6}$$

The point estimate $\widehat{\beta'}$ from equation (5) reflects the SWB benefit of a unit of free IBLI with no indemnity payment. Likewise, the coefficient estimate $\hat{\pi}'$ measures the SWB loss due to a unit of free IBLI that has expired without payout. 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 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.[20]

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

[20] 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 (Table A2).

6. Results

We first discuss the estimated SWB effects of IBLI on the extensive margin, followed by discussion of results on the intensive margin. Table 3 presents the first stage panel FE LPM estimates of equation (2) (columns 2-3) and panel random-effects (RE) Tobit model of equation (4) (columns 4-5). The second column (1) shows results from a basic model with just randomized discount coupon and audio and comic book information extension treatments in SP1 and SP2. In column three (2), in addition to the randomized discount coupon and information treatments in (1), we include a broad range of household characteristics, wealth measures, IBLI knowledge, expectations of livestock loss, and membership in informal insurance networks.[21] 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 SP1 increases the probability of buying IBLI policy by over 10 percent. This effect is even greater for the discount coupon in SP2 – it increases the odds of buying IBLI by about 17 percent. Moreover, having received discount coupons in SP1 increases the probability of buying coverage for recipients of discount coupons in SP2. Besides the price effect of discount coupons, which is captured 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.

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 SP2. 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 and Basmann 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. Thus, this first stage appears to successfully instrument for endogenous IBLI uptake.

[21] IBLI was not available in Borana zone during the baseline survey. Estimates in Table 4 are obtained using R2 and R3 data.

IBLI uptake relates to our control variables in the expected ways. In particular, uptake is positively and significantly related to the number of TLUs owned, likely reflecting the fact that in the Borana community, livestock represent the most important form of wealth, and that wealthy households can afford to buy IBLI policies more than their poorer counterparts can. Other forms of wealth (assets) and income do not appear to have significant effects on uptake. Female headed households are more likely to buy IBLI than male headed households, *ceteris paribus*. This is consistent with findings in previous studies that women, on average, are more risk averse than men (Borghans et al. 2009; Croson and Gneezy 2009). We also find that larger households are more likely to buy IBLI.[22]

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. As with overall IBLI uptake, the number of TLU's owned is positively related to volume of coverage. Interestingly, we also find that, even though IBLI knowledge has little effect on whether to uptake insurance, it 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 2013).

Table 4 reports second stage ordered logit regression results of the effects of IBLI uptake on vignette corrected SWB. Since randomized discount coupon distribution 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. Our results are robust to the inclusion of income, wealth, a range of demographic and household characteristics, and household composition variables.

At the time of the R3 survey implementation, IBLI policies from SP1 and SP2 had already lapsed without payout. Thus, the coefficient estimate on $\widehat{IBLI\_Lapsed}$ captures the negative *ex post* SWB

[22] As a robustness check, we also estimate a probit selection model and find results that are quite consistent with the LPM (Table A6).

effect of having bought an insurance policy that did not pay out. Indeed, the negative and statistically significant coefficient estimate on $\widehat{IBLI\_Lapsed}$ indicates buyer's remorse. More importantly, the magnitude of the coefficient is statistically significantly smaller than that of $\widehat{IBLI}$, suggesting 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. Omission of the $\widehat{IBLI\_Lapsed}$ variable leads to a sharply reduced, albeit still statistically significant, point estimate on the $\widehat{IBLI}$ variable, underscoring 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.[23]

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 (Table 5). Vignette corrected SWB is increasing in the predicted number of TLUs insured. Yet, as IBLI policies lapse without paying, the more TLUs one had insured, the greater the buyer's remorse one experiences. As is the case with IBLI uptake, the positive effect of possessing IBLI contracts 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.

The net aggregate SWB effect of IBLI is presented in Table 6. 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 0.23 points, although these units have no specific informational content given the ordinal 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

[23] Appendix Table A12 presents the regression results from estimating equation (3) using only currently active IBLI policies. This underscores the importance of disentangling *ex ante* and *ex post* welfare effects.

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.

7. 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 A7). 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 corrected 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 is gender of the household head (male=1). As before, larger households report lower SWB. Interestingly, while schooling had little effect on SWB, it appears to have positive effect on SWB relative to others. These results give us more confidence in the robustness of our results.

We then estimate our model using raw SWB, which has not been vignette corrected, for IBLI uptake and volume of TLUs insured (Tables A8 and A9). 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 then re-estimate our model using data from just 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 Tables A10 and A11. Again, we find that all of the estimated coefficients are consistent with our main results in Tables 4 and 5. 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 Tables 4 and 5. As before, SWB rises with wealth and decreases with household size. Male household heads report higher SWB.

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.

8. Conclusions

The number of studies of subjective well-being (SWB) has exploded in recent years, as has the quantity of research on index insurance introduced into rural areas of the developing world. To date, much of the focus in the SWB literature has been on the relationship between SWB and income or assets, or to personality traits in developed countries. There is limited understanding of how institutional factors, access to services, or policy-related issues influence SWB, if at all. This is particularly true in low-income countries (Fafchamps and Shilpi 2008). Few studies link policy-related variables, such as uptake of index based livestock insurance (IBLI), with changes in SWB (Kaminski 2014).

Index insurance such as IBLI, which reduces the drought-related risk faced by pastoralists, has the potential to impact not only material well-being – e.g., by replacing lost assets and reducing adverse coping behaviors – but also to improve non-material well-being, by providing valuable peace of mind for risk averse buyers. Nonetheless, the net effect on SWB cannot ignore potential *ex post* impacts. For example, 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 all of these prospective effects without resorting to strong assumptions about the arguments and functional form of utility functions.

SWB measures seem especially appropriate to establishing the impacts of insurance because commercial insurance, such as IBLI, intrinsically involves a tradeoff between material and non-material well-being if policies are priced above actuarially fair premium rates so as to cover the costs and ensure a profit margin for the underwriter. 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, as is inevitably the case with index insurance products 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.

We use three rounds of annual household panel data collected between 2012 and 2014 in southern Ethiopia, bracketing the introduction of IBLI, 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 also show that if buyer's remorse effects exist and there is any 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.

We find that current IBLI coverage has a strongly positive and statistically significant effect on SWB. We also find statistically significant evidence of a 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 survey 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 are experiencing deterioration of traditional local social insurance practices at the same time as pastoral livelihoods are becoming more risky. As a result, Borana pastoralists may 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.

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Table 1: Randomized Encouragement Design of IBLI

	Round 2		Round 3	
	August-September 2012: (SP1)	**January-February 2013: (SP2)**	**August-September 2013: (SP3)**	**January-February 2014: (SP4)**
Discount coupon total	212	211	288	256
	(0.43)	(0.42)	(0.57)	(0.51)
Comic book total	79	84	0	0
	(0.16)	(0.17)		
Audio tape total	41	44	0	0
	(0.09)	(0.09)		
Discount coupon only	122	133	288	256
	(0.25)	(0.27)	(0.57)	(0.51)
Comic book only	23	31	0	0
	(0.05)	(0.07)		
Audio tape only	7	19	0	0
	(0.02)	(0.04)		
Discount coupon and comic book	56	53	0	0
	(0.12)	(0.11)		
Discount coupon and audio tape	34	25	0	0
	(0.07)	(0.05)		
Sample	**504**	**504**	**511**	**511**

Percentages in parenthesis

Table 2: Summary statistics

	Round 2 and Round 3 values, by insurance status			Round 1 values, by discount coupon receipt		
	Insured	**Uninsured**	**Diff. in mean**	**Discount Coupon**	**No Discount Coupon**	**Diff. in mean**
Subjective well-being (SWB)	3.192	3.049	0.143**	2.868	2.879	-0.011
	(0.041)	(0.036)	(0.056)	(0.065)	(0.082)	(0.106)
SWB relative to Borana pastoralists	3.250	3.138	0.112**	2.884	2.769	0.115
	(0.038)	(0.034)	(0.053)	(0.053)	(0.068)	(0.086)
Vignette corrected SWB	4.079	3.714	0.365***	3.642	3.533	0.109
	(0.068)	(0.058)	(0.092)	(0.085)	(0.112)	(0.140)
Vignette corrected SWB relative to Borana pastoralists	4.100	3.792	0.308***	3.700	3.522	0.178
	(0.065)	(0.057)	(0.089)	(0.081)	(0.104)	(0.132)
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)			
Cartoon	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*	14.405	14.596	-0.091

	(1.671)	(1.050)	(1.874)	(1.120)	(1.866)	(2.044)
Non-livestock assets (‘000 Birr)	4.975	4.630	0.344	2.846	2.642	0.205
	(0.480)	(0.460)	(0.702)	(0.249)	(0.310)	(0.403)
Annual income (‘000 Birr)	20.932	19.180	1.753	18.628	23.135	4.507
	(2.048)	(1.168)	(2.188)	(1.973)	(4.167)	(4.101)
Expected TLU loss (max=52)	13.077	12.989	-0.089	15.451	15.990	-0.540
	(0.410)	(0.362)	(0.566)	(0.516)	(0.686)	(0.038)
Gender of household head (Male=1)	0.774	0.807	-0.033	0.794	0.786	0.008
	(0.021)	(0.016)	(0.026)	(0.023)	(0.030)	(0.038)
Age of household head (years)	50.341	51.884	-1.542	49.087	51.687	-2.600
	(0.915)	(0.726)	(1.176)	(1.019)	(1.388)	(1.703)
Household size (#)	6.561	6.745	0.183	6.261	6.154	0.107
	(0.125)	(0.105)	(0.167)	(0.141)	(0.182)	(0.231)
Non-working age hh members (#)	3.619	3.754	0.134	3.555	3.385	0.170
	(0.090)	(0.071)	(0.115)	(0.102)	(0.134)	(0.168)
Female hh members (#)	3.276	3.330	0.055	3.129	3.028	0.102
	(0.074)	(0.065)	(0.101)	(0.086)	(0.116)	(0.143)
Observations	381	639	1020	310	182	492

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 3: Tobit model estimates of volume of TLUs insured

	LPM estimates of IBLI uptake[1]		Tobit estimates of volume of TLUs insured[2]	
	(1)	(2)	(3)	(4)
Discount: SP1 only	0.103**	0.108**	3.124***	2.730***
	(0.044)	(0.043)	(0.764)	(0.773)
Discount: SP2 only	0.165***	0.175***	2.988***	2.932***
	(0.046)	(0.044)	(0.765)	(0.768)
Discount: SP1 & SP2	0.084*	0.086*	2.402***	2.036**
	(0.046)	(0.044)	(0.823)	(0.824)
Value of discount (%) SP1	0.183***	0.180***	3.737***	4.053***
	(0.056)	(0.053)	(0.892)	(0.890)
Value of discount (%) SP2	-0.007	-0.012	3.296***	2.955***
	(0.065)	(0.063)	(0.908)	(0.911)
Poet tape: SP1 only	0.043	0.062	0.363	0.957
	(0.092)	(0.088)	(1.031)	(1.034)
Poet tape: SP2 only	0.114	0.131*	2.823***	2.801***
	(0.073)	(0.069)	(0.977)	(0.978)
Poet tape: SP2 & SP2	0.129**	0.097	0.836	0.552
	(0.063)	(0.064)	(1.256)	(1.267)
Comic book: SP1 only	0.078	0.063	0.945	0.813
	(0.059)	(0.060)	(0.891)	(0.887)
Comic book: SP2 only	0.068	0.080	1.586*	1.226
	(0.061)	(0.062)	(0.923)	(0.922)
Comic book: SP2 & SP2	0.200***	0.218***	2.632***	2.512***
	(0.073)	(0.070)	(0.787)	(0.789)
IBLI premium: SP1	-	-	0.286	-2.308
			(4.189)	(4.240)
IBLI premium: SP2	0.243	0.213	2.425	3.563
	(0.211)	(0.201)	(2.947)	(3.066)
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		0.128		0.303
		(0.129)		(0.253)
Annual Income ('000 Birr)		-0.000		-0.005
		(0.000)		(0.005)
Household head gender (Male=1)		-0.235*		0.590
		(0.135)		(0.638)
Household head age		0.002		-0.041
		(0.016)		(0.081)
Household age squared		-0.000		0.000
		(0.000)		(0.001)

Household size		0.074***		-0.009
		(0.026)		(0.193)
Household head highest grade achieved		-0.004		-0.176
		(0.008)		(0.124)
Iqub membership		-0.072		-1.354*
		(0.050)		(0.748)
Household composition	No	Yes	No	Yes
Constant	0.086	0.353	-8.403***	-8.256***
	(0.132)	(0.514)	(2.280)	(3.160)
Wald weak instrument test (Kleibergen-Paap Wald F-test) – P-value	0.000	0.000	0.0000	0.0035
Observations	1,015	1,015	1,015	1,015
Number of households	520	520	520	520

[1] Columns 2-3 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 clustered at the panel-*Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1.
[2] Columns 4-5 show Tobit model estimates of volume of TLUs insured. The dependent variable *TLUs insured* is a non-negative continues variable. Bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.
Note: 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.

Table 4: Ordered logit regression: Vignette adjusted SWB estimates using IBLI uptake

Dependent variable: Vignette adjusted SWB	Model (1)	Model (2)	Model (3)
Predicted IBLI uptake	0.822***	0.719***	0.863***
	(0.288)	(0.246)	(0.281)
Predicted lapsed IBLI	-0.454***	-0.439***	-0.443***
	(0.157)	(0.168)	(0.172)
Number of TLU owned	0.014**	0.012*	0.012*
	(0.007)	(0.007)	(0.007)
Asset Index		0.283***	0.239***
		(0.065)	(0.066)
Annual income (‘000 Birr)		0.003	0.004
		(0.003)	(0.003)
Household head gender (Male=1)			0.733**
			(0.309)
Household head age			-0.042
			(0.032)
Household head age squared			0.000
			(0.000)
Household size			-0.224***
			(0.073)
Household head highest grade achieved			0.055
			(0.055)
Observations	1,530	1,530	1,530
Number of households	550	550	550

Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 5: Ordered logit regression: Vignette adjusted SWB estimates using volume of TLUs insured

Dependent variable: SWB	Model (1)	Model (2)	Model (3)
Predicted TLUs insured	0.137***	0.138***	0.144***
	(0.039)	(0.038)	(0.038)
Predicted lapsed TLUs	-0.077***	-0.071***	-0.074***
	(0.025)	(0.026)	(0.026)
Number of TLUs owned	0.015**	0.012*	0.012*
	(0.007)	(0.007)	(0.007)
Asset Index		0.325***	0.290***
		(0.065)	(0.064)
Annual income (‘000 Birr)		0.003	0.003
		(0.003)	(0.003)
Household head gender (Male=1)			0.617**
			(0.308)
Household head age			-0.037
			(0.033)
Household head age squared			0.000
			(0.000)
Household size			-0.192***
			(0.071)
Household head highest grade achieved			0.058
			(0.055)
Observations	1,530	1,530	1,530
Number of households	550	550	550

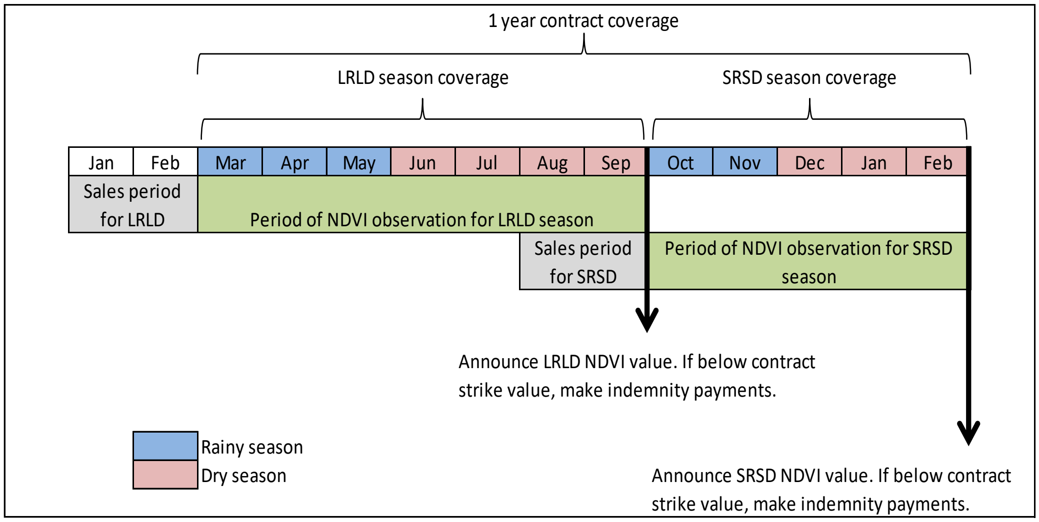
Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table 6: Aggregate effect of IBLI on SWB

Variables	Model (1)	Model (2)	Model (3)
$\Delta\widehat{SWB}_{ivt}$	0.210***	0.218***	0.230***
	(0.075)	(0.072)	(0.071)
Observations	1,530	1,530	1,530

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Temporal structure of IBLI contract



APPENDIX

Table A1: Annual IBLI premium and out of pocket payments

	Aug-Sept 2012; Jan-Feb 2013; Aug-Sept 2013							Jan-Feb 2014						
	Premium (Birr)							Premium (Birr)						
Woreda	(%)	Cattle	Camel	Goat/ Sheep	TLU	TLUs insured	Out of pocket pay per TLU (Birr)*	(%)	Cattle	Camel	Goat/ Sheep	TLU	TLUs insured	Out of pocket pay per TLU (Birr)*
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

* Average out of pocket payment per TLU by actual buyers.

Table A2: 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, cartoon
Sales period 2	January-February 2013; contract active- March 2013-February 2014; Encouragement design- discount coupon, poet tape, cartoon
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 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 household 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 saving and credit institution (arrangement). The variable takes value 1 if a household member is a member of Iqub, and 0 otherwise.

Table A3: 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

Table A4: SWB relative to Borana pastoralists and vignette-corrected SWB relative to Borana

	Vignette corrected SWB_Borana							
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

Table A5: Selection into treatment (Linear probability model)

	Round 2						Round 3	
	DiscSP1	DiscSP2	AudioSP1	AudioSP2	ComicSP1	ComicSP2	DiscSP3	DiscSP4
Expected TLU loss	0.005**	-0.002	0.005**	0.003*	0.003	0.005	-0.005*	-0.001
	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
Number of TLUs owned	-0.001	-0.001	0.000	0.000	-0.000	-0.000	0.001	0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Asset index	-0.006	0.020	0.004	0.004	-0.002	0.006	-0.010	-0.008
	(0.022)	(0.033)	(0.011)	(0.011)	(0.015)	(0.017)	(0.020)	(0.017)
Annual income ('000 Birr)	0.002***	0.001*	0.000	-0.000	0.001	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Household head gender (Male=1)	-0.077	-0.005	-0.078**	-0.048	-0.002	-0.020	0.023	-0.041
	(0.059)	(0.055)	(0.032)	(0.032)	(0.048)	(0.048)	(0.069)	(0.071)
Household head age	-0.002	-0.003	0.000	-0.001	-0.000	0.001	-0.001	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Household size	0.034**	0.021	-0.003	-0.004	0.010	0.005	-0.009	0.011
	(0.017)	(0.016)	(0.010)	(0.016)	(0.010)	(0.016)	(0.019)	(0.020)
Household head highest grade	0.016	-0.011	0.006	-0.009*	0.000	0.001	-0.012	0.000
	(0.013)	(0.011)	(0.007)	(0.005)	(0.008)	(0.008)	(0.014)	(0.011)
Number of females in household	-0.036**	-0.006	-0.021*	-0.011	0.005	-0.006	-0.012	-0.034*
	(0.017)	(0.017)	(0.012)	(0.013)	(0.014)	(0.019)	(0.018)	(0.019)
Household members under 5	0.027	-0.031	0.049***	0.005	0.007	0.026	0.032	0.024
	(0.039)	(0.031)	(0.016)	(0.026)	(0.022)	(0.023)	(0.028)	(0.037)
Household members over 65	-0.029	-0.031	0.022	0.028	-0.018	-0.015	-0.018	-0.007
	(0.022)	(0.023)	(0.014)	(0.020)	(0.012)	(0.013)	(0.023)	(0.024)
Iqub membership	0.039	-0.103	0.003	-0.002	0.004	0.035	0.064	0.143*
	(0.081)	(0.084)	(0.050)	(0.051)	(0.068)	(0.066)	(0.106)	(0.085)
Constant	0.427***	0.583***	0.015	0.124**	0.083	0.071	0.780***	0.559***
	(0.106)	(0.149)	(0.044)	(0.058)	(0.077)	(0.077)	(0.090)	(0.087)
Observations	504	504	504	504	504	504	511	511
Prob > F	0.079	0.138	0.034	0.353	0.321	0.323	0.099	0.642
R-squared	0.054	0.019	0.051	0.032	0.014	0.017	0.035	0.012

Clustered standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Note: Table A5 presents joint tests of orthogonality for the treatment variables. Prior to SP1 and SP2, 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 and 4 discount coupons were distributed to randomly selected households. In columns 2-9, we present the linear probability model (LPM) regression results of selection into one of the randomized treatments in the four IBLI periods. The joint orthogonality test is given in the second bottom row.

Table A6: Probit model estimates of IBLI uptake

Dependent variable: IBLI uptake	Model (1)	Model (2)
Discount: SP1 only	1.819***	1.631***
	(0.287)	(0.272)
Discount: SP2 only	1.841***	1.753***
	(0.303)	(0.292)
Discount: SP1 & SP2	1.625***	1.445***
	(0.328)	(0.307)
Value of discount (%) SP1	0.954***	0.959***
	(0.259)	(0.275)
Value of discount (%) SP2	0.142	0.026
	(0.260)	(0.245)
Poet tape: SP1 only	0.658	0.815
	(0.515)	(0.622)
Poet tape: SP2 only	1.373***	1.333***
	(0.495)	(0.459)
Poet tape: SP2 & SP2	0.247	0.110
	(0.386)	(0.366)
Comic book: SP1 only	0.750**	0.764**
	(0.338)	(0.345)
Comic book: SP2 only	0.317	0.113
	(0.404)	(0.365)
Comic book: SP2 & SP2	0.895**	0.785**
	(0.356)	(0.379)
IBLI premium: SP1	1.662	0.665
	(2.387)	(2.446)
IBLI premium: SP2	1.913*	2.393**
	(1.086)	(1.075)
IBLI knowledge		0.232***
		(0.043)
Expected TLUs loss		-0.001
		(0.010)
Number of TLUs owned		0.006*
		(0.003)
Asset Index		0.028
		(0.071)
Annual Income (‘000 Birr)		-0.001
		(0.002)
Household head gender (Male=1)		-0.217
		(0.165)
Household head age		-0.022
		(0.022)
Household age squared		0.000
		(0.000)
Household size		0.009

		(0.049)
Household head highest grade achieved		-0.025
		(0.033)
Iqub membership		-0.361
		(0.223)
Household composition	No	Yes
Constant	-4.647***	-4.191**
	(1.684)	(1.779)
Observations	1,015	1,015
Number of households	520	520

Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A7: Ordered logit regression: Estimates for Vignette adjusted SWB relative to Borana pastoralists using IBLI uptake

Dependent variable: vignette-corrected SWB relative to Borana	Model (1)	Model (2)	Model (3)
Predicted IBLI uptake	0.953***	0.941***	1.081***
	(0.216)	(0.209)	(0.232)
Predicted lapsed IBLI	-0.350**	-0.336**	-0.364**
	(0.168)	(0.169)	(0.167)
Number of TLUs owned	0.010**	0.009**	0.009**
	(0.004)	(0.004)	(0.004)
Asset Index		0.043	-0.006
		(0.107)	(0.108)
Annual income (‘000 Birr)		0.002*	0.002**
		(0.001)	(0.001)
Household head gender (Male=1)			0.594**
			(0.295)
Household head age			-0.044
			(0.032)
Household head age squared			0.000
			(0.000)
Household size			-0.232***
			(0.088)
Household head highest grade achieved			0.072*
			(0.038)
Observations	1,530	1,530	1,530
Number of households	550	550	550

Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A8: Ordered logit regression: Estimates for SWB using IBLI uptake

Dependent variable: SWB	Model (1)	Model (2)	Model (3)
Predicted IBLI uptake	0.765***	0.604***	0.654**
	(0.238)	(0.229)	(0.296)
Predicted lapsed IBLI	-0.721***	-0.730***	-0.726***
	(0.163)	(0.170)	(0.167)
Number of TLUs owned	0.034***	0.030***	0.029***
	(0.006)	(0.006)	(0.007)
Asset Index		0.205***	0.186***
		(0.075)	(0.072)
Annual income (‘000 Birr)		0.003	0.002
		(0.002)	(0.002)
Household head gender (Male=1)			0.408**
			(0.174)
Household head age			0.023
			(0.023)
Household head age squared			-0.000
			(0.000)
Household size			-0.066
			(0.062)
Household head highest grade achieved			-0.018
			(0.024)
Observations	1,529	1,529	1,529
Number of households	550	550	550

Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A9: Ordered logit regression: Estimates for SWB using volume of TLUs insured

Dependent variable: SWB	Model (1)	Model (2)	Model (3)
Predicted TLUs insured	0.126***	0.128***	0.126***
	(0.043)	(0.042)	(0.042)
Predicted lapsed TLUs	-0.136***	-0.134***	-0.135***
	(0.029)	(0.029)	(0.029)
Number of TLUs owned	0.034***	0.030***	0.029***
	(0.006)	(0.007)	(0.007)
Asset Index		0.231***	0.213***
		(0.067)	(0.064)
Annual income (‘000 Birr)		0.003	0.002
		(0.002)	(0.002)
Household head gender (Male=1)			0.346**
			(0.165)
Household head age			0.025
			(0.024)
Household head age squared			-0.000
			(0.000)
Household size			-0.051
			(0.061)
Household head highest grade achieved			-0.017
			(0.025)
Observations	1,529	1,529	1,529
Number of groups (households)	550	550	550

Standard errors clustered at the reera level in parentheses: ** p<0.01, ** p<0.05, * p<0.1

Table A10: Ordered logit regression: Vignette adjusted SWB estimates using IBLI uptake – panel households only

Dependent variable: Vignette adjusted SWB	Model (1)	Model (2)	Model (3)
Predicted IBLI uptake	0.875***	0.787***	0.955***
	(0.284)	(0.250)	(0.275)
Predicted lapsed IBLI	-0.449***	-0.412**	-0.406**
	(0.169)	(0.185)	(0.190)
Number of TLUs owned	0.013	0.010	0.009
	(0.008)	(0.009)	(0.009)
Asset Index		0.251***	0.209***
		(0.072)	(0.075)
Annual income (‘000 Birr)		0.004*	0.005*
		(0.003)	(0.003)
Household head gender (Male=1)			0.791**
			(0.323)
Household head age			-0.056
			(0.039)
Household head age squared			0.001
			(0.000)
Household size			-0.219***
			(0.069)
Household head highest grade achieved			0.031
			(0.060)
Observations	1,395	1,395	1,395
Number of households	465	465	465

Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A11: Ordered logit regression: Vignette adjusted SWB estimates using volume of TLUs insured – panel households only

Dependent variable: vignette adjusted SWB	Model (1)	Model (2)	Model (3)
Predicted TLUs insured	0.144***	0.146***	0.156***
	(0.039)	(0.038)	(0.038)
Predicted lapsed TLUs	-0.075***	-0.067**	-0.069**
	(0.027)	(0.028)	(0.029)
Number of TLUs owned	0.013	0.009	0.009
	(0.008)	(0.009)	(0.009)
Asset Index		0.303***	0.270***
		(0.066)	(0.066)
Annual income ('000 Birr)		0.004*	0.005*
		(0.003)	(0.003)
Household head gender (Male=1)			0.655**
			(0.320)
Household head age			-0.049
			(0.039)
Household head age squared			0.000
			(0.000)
Household size			-0.181***
			(0.065)
Household head highest grade achieved			0.034
			(0.060)
Observations	1,395	1,395	1,395
Number of households	465	465	465

Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A12: Ordered logit regression: Vignette adjusted SWB estimates using IBLI uptake with omitted lapsed IBLI

Dependent variable: vignette adjusted SWB	Model (1)	Model (2)	Model (3)
Predicted IBLI uptake	0.646**	0.558**	0.708***
	(0.263)	(0.227)	(0.262)
Number of TLUs owned	0.014**	0.012*	0.012*
	(0.007)	(0.007)	(0.007)
Asset Index		0.285***	0.243***
		(0.069)	(0.069)
Annual income (‘000 Birr)		0.004	0.004
		(0.003)	(0.003)
Household head gender (Male=1)			0.746**
			(0.310)
Household head age			-0.046
			(0.032)
Household head age squared			0.000
			(0.000)
Household size			-0.229***
			(0.073)
Household head highest grade achieved			0.049
			(0.054)
Observations	1,530	1,530	1,530
Number of households	550	550	550

Standard errors clustered at the *Reera* level in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Figure A1: Sampled administrative *Woredas* of Borana zone

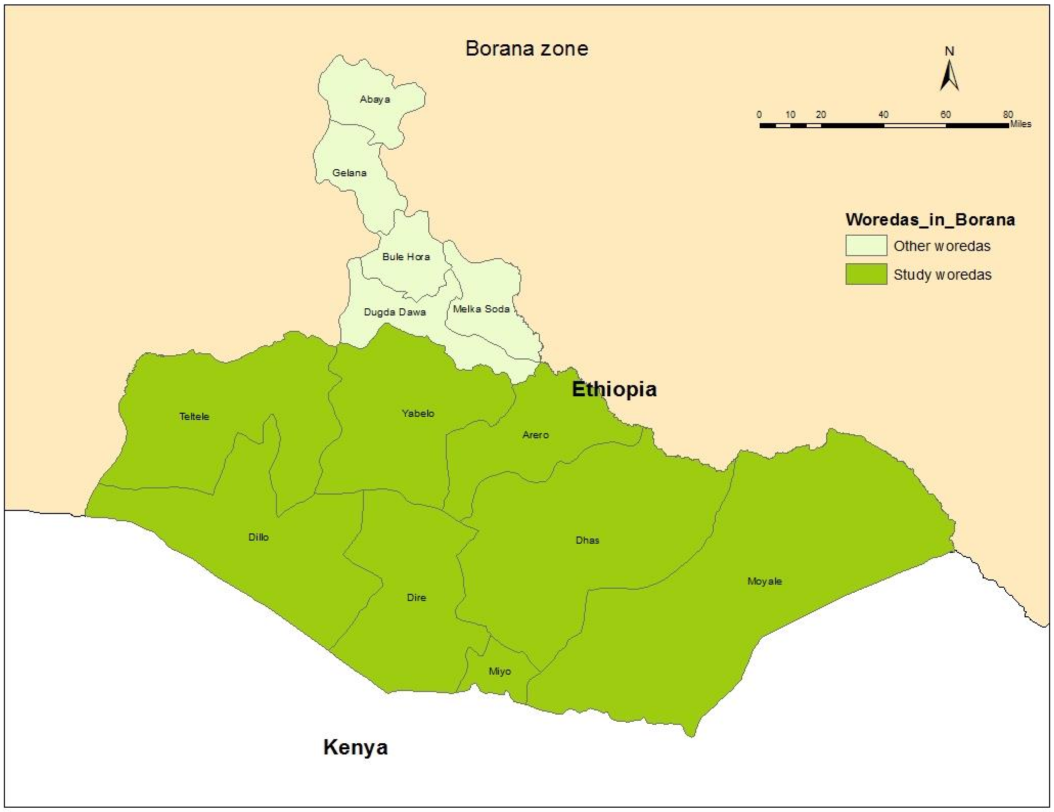


Figure A2: SWB vs. vignette corrected SWB

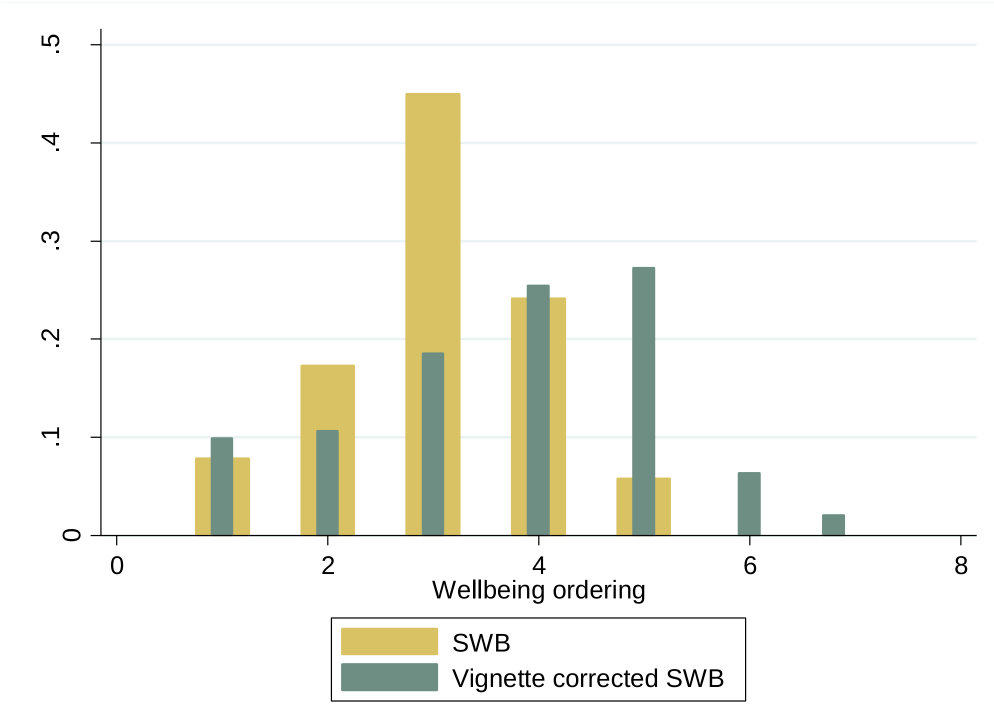
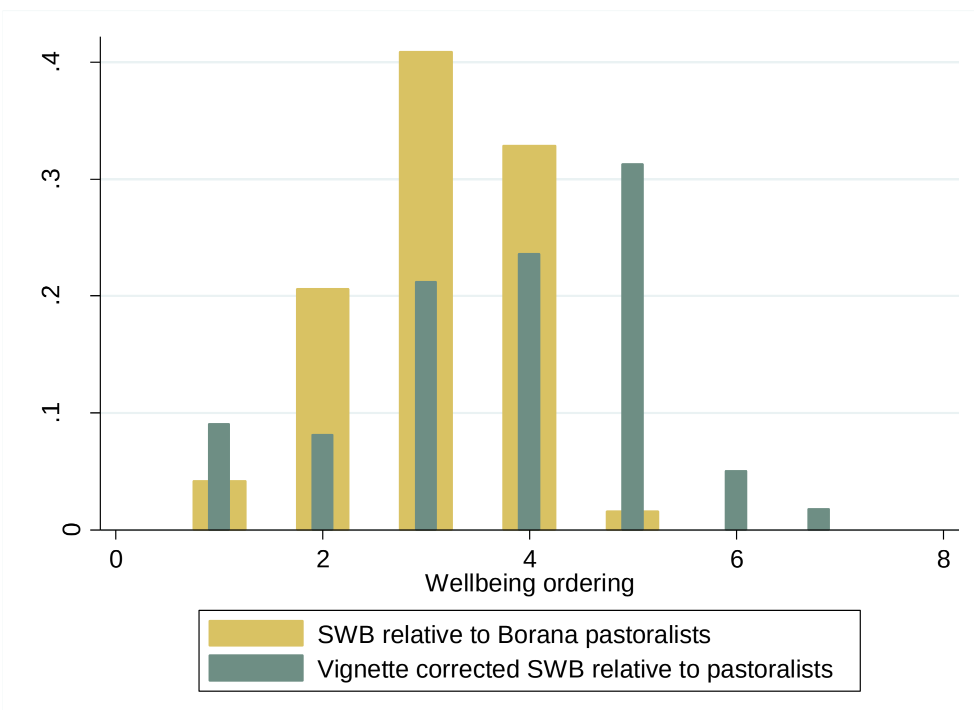


Figure A3: SWB relative to Borana pastoralists vs. vignette corrected SWB relative to Borana



Attrition correction

In this paper 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. 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:

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

and

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

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.

Appendix Table A13 presents probit estimates of the probability of attrition with lagged IBLI and SWB equations. Column one shows that all of the coefficients are individually insignificant, suggesting that attrition is random. Wald joint test of the group (auxiliary) variables (Chi-squared statistic of 26.08 with 23 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 A13: Attrition probit estimates

Dependent variable: Attrition dummy	(1) $IBLI_{t-1}$	(2) SWB_{t-1}
IBLI_lagged	1.193	0.142
	(0.794)	(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 cash 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

Bootstrap standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1