GENDER DIFFERENCES IN DEMAND FOR INDEX-BASED LIVESTOCK INSURANCE

Elizabeth R. Bageant[a]*

Christopher B. Barrett[b]

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[a] Charles H. Dyson School of Applied Economics and Management, Cornell University; erb32@cornell.edu
[b] Charles H. Dyson School of Applied Economics and Management, Cornell University; cbb2@cornell.edu
* Corresponding author

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ABSTRACT

Risk management plays a role in avoiding and escaping chronic poverty throughout the world, particularly for women, who are disproportionately negatively affected by shocks. Using three years of household survey data, administrative records and qualitative interviews, this paper examines the relationship between gender and demand for index-based livestock insurance (IBLI) among pastoralists in southern Ethiopia. Though IBLI appears to be equitably accessed by men and women alike, demand is gender-differentiated along three dimensions: risk aversion, informal insurance and product education channels. We also find modest differences associated with age and share of income from livestock.

INTRODUCTION

Multiple studies demonstrate how, in the developing world, women and their children are disproportionately negatively affected by household-level shocks (Dercon and Krishnan, 2000; Hoddinott, 2006; Hoddinott and Kinsey, 2000; Dercon and Hoddinott, 2005; Behrman, 1988; Rose, 1999). In a majority of these studies, low-income households exhibit larger intra-household inequalities relative to higher income households, suggesting that poor women and their children experience shocks more profoundly than their wealthier counterparts do. As a result, women are overrepresented among the world's poor and vulnerable and therefore may benefit disproportionately from improved risk management (Banthia et al., 2009). The social norms and institutions that render women's physical, social and economic vulnerabilities different than those of men may, at the same time, impact their access to innovative products intended to mitigate the long-term detrimental effects of shocks, such as index insurance. Index-based livestock insurance (IBLI), designed to protect against catastrophic livestock loss due to drought, is one such product, and the question of whether and how access to IBLI coverage varies by gender remains unexplored. Understanding what determines access to IBLI by gender can shape strategies to equitably provide access to this and other innovative risk management products.

Unlike standard insurance, index insurance contracts are not designed around policyholders' actual losses, but around an exogenous index that is supposed to be highly correlated with policyholders' losses. In the case of IBLI, the index was originally designed for implementation in northern Kenya using longitudinal data on herd mortality statistically fit to remote-sensing data known as Normalized Differenced Vegetation Index (NDVI), that depicts the vegetative conditions (that is, greenness and brownness) in these difficult-to-reach areas (Chantarat et al., 2013).[i] When the cumulative deviation of NDVI from mean levels predicts livestock mortality rates beyond a given threshold, insurance payouts are triggered. Compensation varies linearly with the size of the predicted loss. IBLI was subsequently adapted to southern Ethiopia's Borana Zone, the focus of this paper.

Index-based products are particularly useful in developing country settings where insured amounts tend to be small relative to the transactions costs associated with executing a contract in a limited

infrastructure environment. Information asymmetries that plague insurance products (that is, moral hazard, adverse selection) may be more likely to exist in remote parts of the developing world due to poor infrastructure and monitoring capacity.

Despite its potential to overcome difficulties associated with more standard insurance products, demand for IBLI and similar products has been weaker than expected (Jensen, et al., 2014). One key difference between standard insurance products and index-based products that may explain poor demand is basis risk. Basis risk is the mismatch between a policyholder's actual losses and the losses predicted by the index, which can result in the policyholder being compensated for losses he or she did not experience or experiencing losses without receiving compensation. The relationship between basis risk and demand for index insurance has been investigated in multiple contexts and suggests that basis risk has an inverse relationship with insurance demand, but the magnitude of the effect remains largely unknown (Mobarak and Rosenzweig, 2013; Jensen, et al., 2014).

Basis risk aside, theory and prior empirical work suggest that other primary determinants of demand for index-based products include price, trust, credit constraints, understanding of the product and the consumer's attitude toward risk (Hill et al., 2011; Giné et al., 2008). A willingness to pay field experiment and ex ante simulation of IBLI performance suggests that the availability of coping strategies, a household's expectation of loss and herd size are key determinants of demand for IBLI specifically (Chantarat, 2009).

To the best of my knowledge, there are no studies that focus specifically on gender and demand for index insurance products. In northern Kenya in 2010, 62 per cent of IBLI purchases were made by women, while female-headed households made up 37 per cent of the sample, yet Jensen et al. (2014) find no significant gender effect on demand. In Ethiopia, roughly 20 per cent of purchasers are women, which corresponds to the proportion of households that are female-headed. Virtually all purchases in Ethiopia were made by household heads. Takahashi et al. (2014) find that being female is associated with a greater likelihood of IBLI purchase, but a lower total insured herd value. Given these ambiguous findings, and the pastoralist environments in question where men have higher financial literacy, greater control over

assets, more education and access to information, one might expect differential access to innovative risk management products between men and women.

This study exploits the overlap between purchasers and household heads in Ethiopia to understand determinants of IBLI demand that may vary by gender using household-level panel data informed by a series of qualitative interviews. Building on previous empirical findings, we posit that risk aversion, informal insurance, product education and female-held assets are particularly relevant to women's demand for IBLI. Using a combination of qualitative and quantitative approaches, we find no gender difference in overall demand for IBLI, but that there are subtle differences in drivers of demand by gender. We find gender-differentiated average marginal effects of informal insurance access and home-centered marketing on the IBLI purchase decision and level of purchase, respectively. Older age of female household heads is associated with slightly lower demand by women, while women's smaller shares of livestock income is associated with higher demand. Finally, we find evidence of gender influencing IBLI purchase through means not captured in the model, which may be due to vulnerability to pressure by sales agents.

The remainder of the paper begins with a review and discussion of key elements of insurance demand and gender, followed by descriptions of the study setting, and data. We then discuss qualitative findings related to model specification before moving on to the estimation strategy and interpretation of results. After a final discussion of synthesized results, we conclude with implications for policy and further research.

KEY ELEMENTS OF INSURANCE DEMAND AND GENDER

Risk aversion

A consumer's attitude toward risk should be a key determinant of his or her willingness to pay (WTP) for insurance. However, in the case of index insurance, the presence of basis risk may confound

the theoretically positive relationship. If the factors that drive IBLI's basis risk have a gender dimension, then we could expect to see gender-differentiated responses to equal levels of risk aversion.

Much empirical and experimental work has attempted to determine whether there is a relationship between gender and risk aversion and, if so, what the underlying mechanisms of the relationship are. In a review of the topic, Eckel and Grossman (2008) note that many studies on gender and risk aversion lack rigor and fail to control for difficult-to-measure traits like confidence, or even measurable ones such as income or wealth. Furthermore, measures of risk aversion and its associated characteristics, such as perceptions of risk, are likely highly sensitive to context and risk domains (Weber et al., 2002). The vast majority of studies on gender and risk aversion have taken place in experimental settings at American or European universities, often with relatively low stakes. Given the sensitivity of risk aversion measures, caution should be exercised in applying findings from one context to another.

One study of risk aversion in the Ethiopian highlands found no difference in risk preferences between men and women (Yesuf and Bluffstone, 2009), though these results may not be generalizable to pastoralist Ethiopia given the substantial difference between the two settings. In the context of index insurance, Giné et al. (2008) find no relationship between demand and gender, but they suggest an interaction effect between risk aversion and knowledge in that risk averse individuals with little knowledge of the product are less likely to purchase than those with greater knowledge. In cases where women's knowledge of the product is systematically lower, this could translate to a gender effect associated with risk aversion. Similarly, a gender difference in perceived risk of, say, drought, could translate to a gender effect on demand operating through risk aversion. Given the lack of consistent, generalizable findings on gender and risk aversion, the relationship between gender, risk aversion and demand for livestock insurance remains an empirical question. Any differences in the impact of risk aversion on IBLI uptake by gender may be attributable to inadequate controls for product understanding, differences in trust of the product or of the insurance company. We can expect the effect of risk aversion on IBLI uptake to vary by gender, but the direction of the effect remains ambiguous.

Informal insurance

Informal risk management institutions exist in virtually every society and include kin networks based on reciprocity, indigenous lending organizations and similar arrangements designed to mitigate the impact of shocks, either ex ante or ex post. The effect of informal insurance on demand for formal insurance products remains an empirical question. Studies on the coverage of informal risk management institutions, both aggregate and differentiated by income, have repeatedly shown that informal insurance falls short of fully protecting households against covariate shocks and performs only slightly better in protecting against idiosyncratic shocks (see Morduch, 1999; Bhattamishra and Barrett, 2010 for reviews), but whether informal insurance is a substitute for or a complement to index insurance is unclear. Where index insurance protects households against covariate shocks, it may serve as a complement to informal mechanisms that protect against idiosyncratic shocks and a substitute for informal mechanisms, such as remittances, that protect against covariate shocks.

To what extent do informal mechanisms among pastoralists in southern Ethiopia cover idiosyncratic risk? Lybbert et al. (2004) suggest that idiosyncratic risk dominates among these pastoralists and that livestock transfers offer only limited insurance coverage. In the same context, Santos and Barrett (2011) find that that informal loans of cattle function as a safety net rather than as insurance in that loans are given contingent on the borrower's expected gains rather than the borrower having experienced a shock. These two cases suggest that informal mechanisms weakly, if at all, insure pastoralists against idiosyncratic or covariate risk.

Mobarak and Rosenzweig (2013) consider participation in informal networks in the context of index insurance where basis risk is present. They find that participation in networks that cover idiosyncratic risk, as opposed to the covariate risk targeted by index insurance, interacts with basis risk to affect demand for the index insurance product. Where basis risk driven by idiosyncratic risk is high, index-based products complement informal insurance participation, but where basis risk is low informal risk sharing has no effect on demand. If idiosyncratic risk is poorly covered by informal mechanisms

IBLI is unlikely to complement informal insurance. If that is the case, then informal insurance should have a negative or no effect on demand for IBLI.

While none of the above findings pertain specifically to gender, women's risk might be less covered by informal institutions than that of men, due to differences in wealth or social connectedness. Even if IBLI were to cover covariate shocks perfectly over a given index area, women's experience may be more or less like the average of the index area. If gender is correlated with something that makes women different from the average, such as social connectedness, this could drive levels of idiosyncratic losses.

Additionally, access to informal groups and networks is not exogenously determined and thus the most vulnerable might be excluded from some informal insurance arrangements due to their inability to keep up with reciprocity arrangements or pay entry costs (Santos and Barrett, 2011; Cohen and Sebstad, 2005; Bhattamishra and Barrett, 2010). A gender effect operating through variation in wealth or social networks may emerge in econometric analysis if adequate measures of these attributes are not included. It is also important to remember that heterogeneity within female-headed households likely plays a role, as the marital status of a female household head is likely correlated with her wealth and the nature of her social networks. If female-headed households and male-headed households are engaged in different types of informal insurance or experience different levels of coverage, they may exhibit a different demand pattern for an index-based product.

IBLI product education

The challenges of marketing a sophisticated insurance product to remote communities with high illiteracy and limited prior exposure to formal insurance cannot be understated, and consumer understanding of how the product works is essential to making the decision to purchase. Thus, marketing of index-based insurance products necessarily involves an education component. When information channels are male-dominated and women are difficult to reach, gender sensitivity in marketing and education matters for uptake by women (Banthia et al., 2009).

Anecdotal evidence suggests that women do not have access to the information they want about IBLI, but it is not clear whether this is a gender-specific phenomenon. Women's community involvement and market participation is clearly on the rise in Borana (Hertkorn ,2013; McPeak et al., 2011), suggesting that the extent to which women are able to access information channels may also be in flux. The successful education of women about IBLI hinges upon effective strategies for accessing women. We would expect that education through female-accessible channels would have a stronger positive association with IBLI uptake by women relative to men.

Female assets and bargaining power

Asset holdings have implications for avoiding chronic poverty and, worldwide, women tend to command fewer assets than men (Deere and Doss, 2006). Pastoralist regions in Ethiopia are consistent with this. In this setting, livestock is the primary asset, but intra-household ownership arrangements are complex. Previous work investigating gender and livestock ownership focuses almost exclusively on household-level livestock ownership in relation to the gender of the household head rather than intra-household ownership arrangements. McPeak et al. (2011) suggest that male-headed households in southern Ethiopia and northern Kenya are more likely to own all types of livestock, while female-headed households are more likely than male-headed households to own no livestock at all, but the intra-household details of these ownership arrangements are not clear.

Although in pastoralist Ethiopia, ownership is not clearly articulated, it can be argued that women hold special rights over animals that are lactating, because milk production and caring for young animals falls squarely into the female domain in these societies (Coppock, 1994; McPeak et al., 2011). Lactating animals thus generate a large portion of the female income stream and lactation rates themselves are sensitive to drought. Given these factors, one would expect women to have greater incentive to insure when there are many lactating animals in the household herd. At the same time, a woman's control over lactating animals and associated income might increase her capacity to self-insure and lower her WTP for IBLI. Therefore, the relationship between such assets and IBLI uptake remains ambiguous.

Asset ownership can also increase a woman's intra-household bargaining power, which is important in cases where the unitary model of household decision-making fails and household members do not share identical preferences (see Chiappori and Donni, 2009 and Alderman et al., 1995 for discussions of the unitary model). McPeak and Doss (2006) demonstrate contested decision-making processes in milk marketing decisions in northern Kenya, supporting the conclusion that preferences are likely different among household members. In the context of non-identical preferences, one of the factors that shapes an individual's bargaining position within a household is her defection point, or what she can expect to walk away with if bargaining fails and the household dissolves. The control a woman exerts over household assets such as livestock influences her defection point. Women's incentive to insure could be positively correlated with the size of her endowment, which would in turn be positively correlated with bargaining power, suggesting potential for a positive relationship between female assets and female IBLI purchase. Bargaining factors lead us to expect that female assets have a stronger positive effect on IBLI uptake by women than by men, but considering the ambiguity of the relationship between wealth and IBLI uptake mentioned above, the overall effect is ambiguous.

In light of the four elements of gender and microinsurance demand discussed above, the remainder of this analysis considers demand for IBLI for an individual *i* at time *t*, (Y_{it}) as

$$Y_{it} = f(G_i,\ R_i, I_{it}, K_{it}, A_{it}, P_{it}, V_{it-1}, X_{it}) +\ \varepsilon_{it}$$

where G_i represents gender, R_i represents an individual's time-invariant risk aversion, I_{it} represents informal insurance coverage, K_{it} represents product education and A_{it} represents female assets. Additionally, P_{it}, V_{it-1}, and X_{it} represent, respectively, price, current IBLI coverage and a host of demographic and insurance-related controls. Finally, ε_{it} represents a disturbance term. Before specifying the model in depth, we turn to discussion of the setting, data and key variables.

SETTING AND DATA

The International Livestock Research Institute (ILRI), Cornell University, and the Oromia Insurance Company (OIC), in collaboration with local government agents, and numerous researchers, introduced the IBLI product in the southernmost part of the Oromia Regional State of Ethiopia in August 2012, following the successful piloting of a similar product in neighboring northern Kenya in January 2010. IBLI is marketed and sold by OIC, with technical support provided by ILRI. IBLI policies are sold twice a year in August/September and January/February, which correspond to the ends of the dry seasons of the region's bimodal rainfall pattern. Contracts cover a one-year period and individuals choose the number of animals they insure. IBLI is priced by geographic region and species, according to drought risk. Insurance premiums range from 7.5-11 per cent of the estimated value of the animal.

This analysis takes advantage of three sources of data. The introduction of the IBLI product involved collection of annual household survey data and several experimental features, all of which were designed to aid in impact assessment and encourage IBLI uptake. We validate key aspects of the survey data using OIC administrative sales records. Informed by initial exploration of two rounds of survey data, We implemented a complementary qualitative data collection tool in April 2014 with the express purpose of addressing gaps in the survey data and enhancing understanding of key concepts relating to IBLI uptake and gender.

Survey and Administrative Data

The survey sample was selected prior to IBLI implementation to capture geographic, agro-ecological and livelihood variation in the eight southernmost woredas of the Oromia Regional State where IBLI would be offered. The household survey sample was clustered by reera, a subunit of the woreda, containing approximately 100-300 households. Reeras inaccessible by vehicle were excluded for logistical and cost reasons.[ii] For the selected reeras, local government development agents (DAs) were deployed to compile household rosters containing the name of the household head and livestock holdings.[iii] Stratifying by livestock terciles, a proportional random sample of 15 per cent of each reera was

drawn with a minimum rule of 25 households per reera. Where 15 per cent of households in one reera did not meet the 25 household minimum, neighboring reeras were combined into a single sampling unit, making a total of 17 sampling units (ILRI, 2014).

The household survey is conducted annually in March, following the conclusion of the January/February IBLI sales period. Baseline data were collected in 2012 with repeated data collection in 2013 and 2014. Though data are collected annually, many variables are collected using a monthly or seasonal recall structure. This allows for analysis using two periods within each year that correspond to the twice-yearly IBLI sales period and bimodal rainfall pattern, as depicted in Figure 1.[iv] Data are collected on a broad range of household characteristics and behaviors relating to livelihoods, livestock management, herd dynamics, wellbeing, risk management and demographic characteristics. Baseline data consist of 515 households. After attrition and missing data, 456 households are retained for analysis.[v]

In order to encourage uptake of IBLI and aid in understanding the effects of liquidity constraints on insurance purchase, discount coupons were randomly distributed to 80 per cent of households across all reeras in the sample. Only 55 per cent of households reported having received the discount coupon, suggesting some implementation or recall error, therefore we use assignment data, rather than household self-reported data. Discounts ranged from 10-80 per cent for purchase of up to 15 tropical livestock units (TLU) of livestock.[vi] The remaining 20 per cent of households received no coupon.[vii] Because recall of coupon receipt and discount amounts was imperfect, we use assignment data, cross-validated against OIC records where possible, rather than that reported by survey respondents.

The 2014 survey data collection involved two features designed to contribute to this study. First, marital status for all female-headed households was verified and, where the household head was a married female, additional information about the status of the husband was gathered. This served to validate previously collected marital status data. Second, ILRI collected information on the endowment of livestock brought to the household by brides at marriage, as well as information on current stocks and recent flows of such animals.

Qualitative Data

Following Patton (2002) the qualitative sample is stratified along the key dimensions of IBLI purchase history and gender of household head. To better understand heterogeneity within female-headed households, we stratify within this category by marital status. This created eight unique categories from which we intended to sample two households at specific points along the distribution of wealth, measured by the household's herd size during the 2014 survey period (see Appendix C for complete description of qualitative methodology). Based on this sample, qualitative interview data were collected from 15 survey households in April 2014.[viii] The interview guide was designed after preliminary analysis of the first two rounds of survey data in order to complement survey data in order to test the four conceptual hypotheses outlined above.

In particular, the qualitative data provided an opportunity to examine the perceptions of risk associated with IBLI in order to better understand the role of risk aversion. Interviews also explored the nature and extent of informal insurance coverage in Borana and perceptions of differences in coverage between men, women and people of different marital statuses. Lastly, interviews elicited consumer preferences surrounding sources of information about IBLI and the stated reasons for these preferences. Qualitative data also provided an opportunity to enhance description and contextual understanding, and bring new information about heterogeneity to categories and behaviors that appear homogeneous in the survey data. Ultimately, the qualitative data validated survey data to improve the identification and understanding of measurement error in key variables, thus informing variable construction, econometric model specification and interpretation of econometric results. The most salient qualitative findings are reported in the following discussion of variable construction and, later, in the interpretation and discussion of econometric findings.

KEY VARIABLES

IBLI purchase and TLU insured

The ILRI survey contains a question asking if the respondent purchased *insuraansii horrii,* or livestock insurance, in the past year and the qualitative sample was selected based on reported purchase behavior. However, we found significant error in these variables when implementing qualitative interviews, which led us to validate survey responses using OIC administrative data. When compared against administrative data, only 87% of respondents correctly identified their recent purchase behavior. Of all misreported purchases, 80 per cent were false positives while only 20 per cent were false negatives, indicative of systematic over-reporting of IBLI purchase. The majority of false positives were households that had purchased IBLI at least once in previous years, but appeared to misunderstand the reference period of the survey question. Other false positives were households that may have failed to make the distinction between purchasing the IBLI product and being part of the survey sample. A majority of households (73%) in our qualitative sample conflated the ILRI survey or visits by OIC and ILRI staff with the IBLI product at least once in the interview when asked about *insuraansii horrii,* suggesting that people understand the term in a variety of ways. False negatives are likely due to the interviewee in the survey being different from the person who purchased and poor information sharing within the household, a pattern that could also contribute to false positives. Given the non-random nature of the measurement error in reported IBLI purchase, and its centrality to this analysis, for the main analysis we use OIC administrative IBLI purchase data as the dependent variable, instead of reported IBLI purchase.

Gender of IBLI purchaser

The gender of the household head is the most practical proxy for gender of purchaser, given that it is highly correlated with the gender of the person named on the insurance contract (bivariate correlation coefficient of 0.94). Furthermore, in the limited cases where the head was not the purchaser, one might assume that the household head influences the purchase decision in some way and, indeed, this dominates in the qualitative data on decision making. Being the household head was cited as the reason the respondent had the most influence over a livestock or budget allocation decision in 67% of households. In this analysis, a female-headed household with a male individual named on the insurance contract is

considered a female IBLI purchase and vice versa. Neither of these cases is a common occurrence in the survey data where women in male-headed households made only 2.2 per cent of total IBLI purchases and 1.3 per cent of purchases were made by men in female-headed households.

Risk aversion

The baseline household survey included a risk preference experiment in which the respondent chooses from a set of six gambles where risk and expected outcome are positively correlated (ILRI, 2014). Using these data, we create a set of binary variables by combining the two lowest, middle and highest levels of risk aversion to represent low, moderate and high risk aversion.

Informal insurance coverage

Finding a meaningful indicator of informal insurance coverage is a challenge. Prior studies' use of informal cash and in-kind transfers between households and network group participation as measures of informal insurance coverage (Lybbert, 2004; Jensen et al., 2014), motivated qualitative data collection tailored to explore the extent to which these institutions—groups and transfers—serve an informal insurance function in the Borana context. It appears that network groups and transfers capture participation in institutions that may function as informal insurance, but not all groups and not all transfers are insurance.

The network groups captured in the survey—mostly savings and loan groups and small business groups—provide extremely limited idiosyncratic insurance coverage and may not be meaningful as a measure of informal insurance. While all but one group allowed members to take out loans when facing a shock, the three respondents who had taken advantage of this option described the group contribution to the wellbeing of their household as 'small' or 'low' compared to other sources of assistance in difficult times. Two respondents stated explicitly that the group had not helped them to date and the remaining six respondents were unwilling to say the group had no benefits but at the same time were unable to articulate benefits they experienced.[ix]

Qualitative data suggest that the decision to give a transfer is driven by two factors. The first, which was demonstrated in the data from 100 per cent of qualitative respondents, is the normative belief that one is obligated to help those who are most in need, regardless of transfer history. The second consideration is the giver's recollection or expectation of reciprocity by the receiver, which was stated directly by 60 per cent of qualitative respondents. Qualitative validation of 58 specific transfers recorded in the survey data suggested that nearly half of transfers may be insurance-related in that they provide one of several overlapping types of coverage described by McPeak (2006) in the form of ex ante investment in future incoming transfers from recipients (50%), ex ante preparation for the receiver in anticipation of a planned expense such as a birth or marriage (34%) and/or ex post coping for the receiver after an idiosyncratic shock (42%). In light of qualitative findings, informal insurance is represented using the total of the absolute values of monthly cash and in-kind transfers received and given by the household in order to capture not only the insurance a household experiences in the form of a transfer receipt, but also the insurance a household experiences when they engage in ex ante insurance behaviors by giving to others with the expectation of reciprocity.

Product education

The survey captures the IBLI education experience of the household based on 14 specific questions about sources of information through which the household learned about IBLI. Qualitative interviews probed the ways that people learned about IBLI and which information channels worked and didn't work for them individually. Again, the issue of whether people consider the difference between the IBLI product and participation in the IBLI survey sample comes into play. When asked about learning about *insuraansi horrii*, nearly half (46%) of respondents focused initially on 'learning' that the IBLI team was coming to do the survey (that is, being informed to stay home and wait for the enumerator) or similar administrative information rather than increasing their understanding of how the IBLI product functions. During the interviews, we took care to clarify the focus of our interest, but it is unlikely that enumerators did so during survey data collection. While all respondents—male and female—indicated

that they prefer to be taught about IBLI in their homes for such reasons as convenience, reducing distractions and increased opportunity to ask questions, one might expect that this is more important for women whose domestic responsibilities, such as caring for children, cooking and looking after lactating and newborn animals, limit their mobility. Additionally, only two women indicated that they attended community meetings where IBLI was discussed, and both opted to listen and let others ask questions.

One approach to measuring the product education experience of the household using existing data is the number of separate sources of information about IBLI that the household received. The survey data do not capture the intensity of information or the type of information received through these sources, so this fails to disentangle IBLI product-focused information itself from information about the implementation of the survey or the presence of OIC sales agents in the community. Another approach is to incorporate survey data on the 'most important source' of IBLI information, however qualitative data completely contradicted patterns in the survey data.[x] Another approach is to use only information sources that are explicitly product-focused such as radio, posters and OIC extension agents, but this fails to account for the unanimous sense among women that learning is more difficult in away-from-home settings. A woman may learn less from a product-focused information session at a community meeting and more from an incidental conversation about IBLI with a health worker performing a home visit. Coincidentally, home-centered and product focused information channels are nearly mutually exclusive (Table 1). The intersection of these two categories consists of radio broadcasts — only 10 per cent of the sample owns a radio — and the cartoon/tape intervention assigned to one third of households in the first sales period only. Thus, in the variable construction decision there is a tradeoff between different types of measurement error associated with product-focused channels versus home-centered channels. Home-centered channels may be biased upward from information 'learned' related to implementation that is reported as IBLI product information, while product-focused channels may present information focused on the IBLI product directly, but without capturing the level of learning that took place. Given the importance of home-centered information to women, we opt to structure the variable as the proportion of total information sources that are home-centered.

Female assets

A good proxy for intra-household bargaining power will be correlated with a woman's bargaining power, but not endogenous to her decision to purchase IBLI. Commonly used proxies for bargaining power include women's inherited assets, women's current assets, women's income shares, unearned income and assets, and human capital brought to marriage (Quisumbing and Maluccio, 2003; Hoddinott and Haddad, 1995; Schultz, 1990; Thomas, 1990). We propose two different context-appropriate measures of female-controlled assets as proxies for bargaining power.

In the process of marriage in Boran culture, the bride and groom bring livestock gifted from their family members to the newly-formed household herd. Cattle from the bride's father are known as *horrii siiqqee* (HS). Focus group discussions suggest that while everyone considers all animals to belong to the household, HS cattle and their descendants are identifiable by all as part of the wife's endowment and that there may be subtle restrictions on what can be done with these animals (for example, selling, slaughtering, gifting) without the wife's consent. Importantly, the wife retains these cattle in the rare, but possible, event of a divorce. At the same time assets gifted by family members at marriage may be correlated with the degree to which a woman's family invested in her physical and social wellbeing throughout her childhood. As such, a married woman's decision to purchase IBLI may be influenced by her bargaining power, but also directly influenced by the unobserved ways her parents invested in her as a child. Quisumbing and Maluccio (2003) suggest that virtually all proxies for bargaining are vulnerable to endogeneity, but that a strength of using assets brought to marriage is that, unlike current asset holdings, it is unaffected by endogenous decision-making processes within the marriage. HS animals are expressed as a percentage of original herd at marriage. An alternate measure of bargaining power using current assets controlled by the woman can be proxied by the number of lactating animals in the household herd. Milking and milk products represent the female contribution to the economy of the household (Coppock, 1994; Hertkorn, 2013). Lactating animals are expressed as a percentage of total herd.

RESULTS

Summary Statistics

As summarized in Table 2, panel households are 21 per cent female-headed, a majority of whom are widows. Married female household heads comprise 20 per cent of the female-headed households and tend to be polygamous households where multiple wives maintain separate households, or cases where men were away herding at the time of the survey. In terms of female headship, the sample is consistent with other estimates of the prevalence of female headship in Ethiopia which range from 9 per cent of married households countrywide (Fafchamps and Quisumbing, 2002) to 29 per cent of households in southern Ethiopia specifically (McPeak et al., 2011). Ethnically, households were overwhelmingly Boran and practiced traditional forms of religion. More than three quarters of households are fully settled and few households remain nomadic.

Table 3 shows the overall means for the full sample as well as means for male and female-headed households and differences. Detailed information on the construction of all variables is located in Appendix A. Households in the sample have, on average, 19 TLU of livestock. Total income is, on average, equivalent to $190 USD per household per month, only about $18 of which are cash earnings. Given the average household size of 7.3 individuals, this implies an average income of roughly $0.86 per day, 90 per cent of which is in-kind, highlighting widespread poverty and the subsistence economy in the region. Male-headed households (MHHs) have per-person income of $0.89 per day while female-headed households have a per-person income of $0.68. Other statistically significant differences between male and female-headed households suggest potential for gender-differentiated IBLI demand. Female-headed households (FHHs) have, on average, smaller herds, lower total income, and lower participation in transfers and network groups. FHHs' reliance on livestock income is 14 percentage points lower than men. Between male- and female-headed households there is no difference in highest educational attainment of any household member, but female households heads have significantly lower personal educational attainment than male household heads and also scored lower on a financial literacy test conducted at baseline. There are no differences in risk aversion or expectations of upcoming rangeland

conditions. Female household heads are, on average, older than male household heads, probably due to the number of widows and longer female life expectancy. FHHs are smaller by almost two people, yet there is no apparent difference in dependency ratios. Members of FHHs also participate in fewer network groups. These two features are likely due to MHHs consistently containing at least two adults while most FHHs contain only one. With respect to IBLI, FHHs have fewer sources of IBLI information, yet this is not reflected in a lower score on a series of questions designed to test an individual's knowledge of IBLI. The rate of IBLI purchase does not differ by gender of household head. FHHs that insure animals, insure fewer animals, though the percentage of herd insured is not significantly different between household types.

These means tests demonstrate multiple pathways in which demand could shift for women. To the extent that income and wealth impact demand, one might expect lower demand for IBLI in female-headed households due to smaller herd sizes and lower incomes, or, conversely, if income increases the capacity to self-insure, one might see higher demand among lower-income groups such as women. Gender differences in the proportion of income from livestock could also shift demand in either direction, depending on whether reliance on livestock income provides an incentive to insure or, given that it is largely in-kind, constrains liquidity with which to purchase insurance. Gender differences in education and financial literacy have the potential to impact demand for any financial product, yet this would likely operate through their understanding of the product which appears to be similar in this case. If there is an age dimension to the adoption of new financial products, female-headed households, being older on average, may exhibit differential demand. These possibilities will be further explored through regression analysis after examining the characteristics of IBLI purchasers and non-purchasers in greater detail.

At the aggregate level, there are many differences between purchasers and non-purchasers (Table 4). Purchasers have larger herds, fewer non-livestock assets and a larger proportion of their income comes from livestock, consistent with the idea that dependence on livestock contributes to IBLI demand. Purchasers have greater financial literacy and IBLI-specific knowledge, highlighting the importance of the relationship between product understanding and uptake, although causality could flow either or both

directions between those variables. An interest in the product could induce learning and understanding, or exogenous exposure to information that improves one's understanding of the product could prompt purchase of IBLI. Contrary to standard insurance demand theory, IBLI purchasers have lower risk aversion, suggesting that IBLI may not be perceived as risk-reducing, yet at the same time purchasers are more likely to expect below-normal rangeland conditions. Purchasers had greater access to home-centered information sources than non-purchasers, but we see no differences in total information sources between these groups.

Among women, few differences emerge between purchasers and non-purchasers. Purchasers continue to have fewer non-livestock assets, but aggregate differences in herd size and proportion of income from livestock do not hold for the female subsample. Female purchasers do appear to give and receive less total transfers, suggesting potential for an inverse relationship between informal insurance and demand for IBLI. IBLI knowledge remains important for women's demand.

When comparing purchasers by gender, the differences presented in the final columns of Table 4 largely mirror differences in the population as a whole presented in the final columns of Table 3. Notably, the absolute amount of TLU insured is significantly higher for men than for women, yet the proportion of herd insured is not significantly different.

Econometric Strategy and Challenges

The econometric approach to estimating gender-differentiated demand for IBLI involves estimating determinants of an individual's propensity to insure as well as the level of coverage purchased by that individual. The binary purchase decision can be expressed as:

$$Pr(Purchase_{it} = 1) = \Phi(\alpha + \gamma_1 G_i R_i + \gamma_2 G_i I_{it} + \gamma_3 G_i K_{it} + \gamma_4 G_i A_{it} + \delta_0 G_i + \delta_1 R_i + \delta_2 I_{it} + \delta_3 K_{it} + \delta_4 A_{it} + \eta V_{it-1} + \varphi P_{it} + \nu Z_{it} + \zeta X_{it} + \mu_i + \varepsilon_{it}) \quad (1)$$

in which the purchase decision, $Purchase_{it}$, by individual i in period t is regressed on gender, G_i, where $G_i = 1$ represents a female-headed household, as well as interactions of G_i with the variables of interest described in detail. R_i is a vector of dummy variables representing three levels of risk aversion, I_{it} represents informal insurance coverage in the form of cash and in-kind transfers, while K_{it} represents home-centered sources of information about IBLI and A_{it} represents female assets. We include the first-order interacted variables and controls for price (P_{it}), current coverage (V_{it-1}), and household characteristics (X_{it}). We also include Z_{it}, binary indicator of receipt of the randomly assigned discount coupon, independent of the discount received, which is incorporated into the regression as part of P_{it}[xi]. The composite error term consists, of μ_i, the unobserved individual effect, and ε_{it}, the idiosyncratic error with zero mean, finite variance σ_ε^2 and distributed i.i.d over all observations. Probit regression of equation (1) allows us to estimate the average marginal effects (AME) of the variables of interest on the probability of IBLI purchase, allowing for the possibility that they might vary by gender.

The level of coverage purchased, TLU_{it}, can be understood best by incorporating the predicted propensity to purchase from the purchase decision results in order to correct for prospective selection bias arising from the fact that values of TLU_{it} are only observed when $Purchase_{it} = 1$. Level of purchase is modeled as

$$TLU_{it} = \alpha + \gamma_1 G_i R_i + \gamma_2 G_i I_{it} + \gamma_3 G_i K_{it} + \gamma_4 G_i A_{it} + \delta_0 G_i + \delta_1 R_i + \delta_2 I_{it} + \delta_3 K_{it} + \eta V_{it-1} + \varphi P_{it} + \nu Z_{it} + \zeta X_{it} + \beta \lambda_{it} + \omega_i + \xi_{it} \quad (2)$$

where TLU_{it} is regressed on interaction terms, first-order variables and the same set of controls as the first stage. The unobserved individual effect and idiosyncratic error term are represented by ω_i and ξ_{it}, respectively. With the discount considered separately, the coupon, Z_{it}, merely represents a paper reminder of the existence of the IBLI product and the idea of purchase. As such, Z_{it} is justifiably excluded from the second-stage regression under the assumption that once the individual has already made his or her

purchase decision, the reminder effect of coupon itself is irrelevant to the amount of insurance coverage purchased. Following Heckman's (1979) approach to correcting selection bias, we incorporate the inverse Mills ratio.

$$\lambda_{it} = \frac{\phi(\widehat{purchase}_{it})}{\Phi(\widehat{purchase}_{it})} \tag{3}$$

When λ_{it} is calculated as a function of the same set of covariates in the first stage regression as is used in the second stage, selection is theoretically accounted for, but in practice the process is strengthened by the inclusion Z_{it}, the exogenous instrument in the first stage that predicts selection that has no relevance to the second stage dependent variable.

Recall that in both equations, the composite error term consists of the unobserved individual fixed effect and the idiosyncratic error. The unobserved individual fixed effect is likely to induce bias if a pooled estimator is used. A fixed-effects estimator may be tempting, but the probit regression is then subject to the incidental parameters problem in estimations where the number of observations is large relative to the number of time periods, as is the case in these data. Furthermore, we are most interested in time-invariant household characteristics, which would wash out in a fixed-effects estimator. A random effects estimator will be consistent if the individual effect is uncorrelated with covariates, an assumption that is unlikely to hold. Building on Mundlak (1978) and Chamberlain (1980), Wooldridge (2002) proposes that, to the extent that the individual effect is associated with within-household means of time-varying household characteristics, incorporating these means as controls can reduce the bias associated with a simple pooled estimator in the presence of fixed effects. To do so, time varying covariates in X_{it} are used to generate a set of within-household means, $\bar{X}_i$, which are incorporated as additional controls. Time-variant elements of X_{it} include herd size, income, income from livestock, expected rangeland conditions, household demographic controls, previous period losses, non-livestock assets and cash

savings. Time-invariant elements of X_{it} include financial literacy, household head education, and a set of geographical dummies. The two-stage Heckman correction is then estimated using

$$Pr(Purchase_{it} = 1) = \Phi(\alpha + \gamma_1 G_i R_i + \gamma_2 G_i I_{it} + \gamma_3 G_i K_{it} + \gamma_4 G_i A_{it} + \delta_0 G_i + \delta_1 R_i + \delta_2 I_{it} + \delta_3 K_{it} + \delta_4 A_{it} + \eta V_{it-1} + \varphi P_{it} + \nu Z_{it} + \zeta \bar{X}_i + \mu_i + \varepsilon_{it}) \quad (4)$$

and

$$TLU_{it} = \alpha + \gamma_1 G_i R_i + \gamma_2 G_i I_{it} + \gamma_3 G_i K_{it} + \gamma_4 G_i A_{it} + \delta_0 G_i + \delta_1 R_i + \delta_2 I_{it} + \delta_3 K_{it} + \eta V_{it-1} + \varphi P_{it} + \zeta_0 X_{it} + \zeta_1 \bar{X}_i + \beta \lambda_{it} + \omega_i + \xi_{it} \quad (5)$$

to formally test the following four hypotheses:

1. The effect of risk aversion (R_i) on IBLI uptake is invariant with respect to gender (G_i).

   H_0: γ_1=0

2. The effect of informal insurance (I_{it}) on IBLI uptake is invariant with respect to gender (G_i).

   H_0: γ_2=0

3. The effect of product education (K_{it}) on IBLI uptake is invariant with respect to gender (G_i).

   H_0: γ_3=0

4. The effect of female assets (A_{it}) on IBLI uptake is invariant with respect to gender (G_i).

   H_0: γ_4=0

Econometric Challenges

Simultaneity between an individual's knowledge or understanding of the IBLI product and their decision to purchase may leave the knowledge variable correlated with the idiosyncratic error term over time. The most logical potential instruments for the knowledge variable are two randomly assigned educational treatments implemented in the initial rollout of IBLI in Ethiopia. Preliminary analysis found

these two variables to be only weakly correlated with households' understanding of the IBLI product over the time period in question for this study.[xii] To the extent that households adjust informal insurance behaviors based on whether they have purchased IBLI or not, or their level of coverage, the informal insurance variable will also be correlated with the error term. The lagged dependent variable, V_{it-1}, representing previous period IBLI purchase, or, put otherwise, whether an individual is covered in the current period, is likely correlated with household unobservable characteristics that impact the current purchase decision. Given the lack of suitable instruments to address these endogenous variables, results should be interpreted with this likely endogeneity in mind as reflecting associations between the variables but without any clear causal link. Other potentially endogenous variables include herd size and income, because income is primarily composed of herd-related income. The extent to which these related variables are endogenous depends on the ways in which households adjust their herding practices in response to being insured and differences in effects of drought on herd size between those who purchased IBLI and those who did not. As of data collection in March 2014, no Ethiopian households had received an IBLI indemnity payout. One might expect the credibility of the product and subsequent likelihood of detectable behavioral and herd size effects to develop substantially after a payout, but not before.[xiii]

Econometric Results

Purchase decision

Marginal effects from the first-stage probit regression of the IBLI purchase decision are presented in Table 5. We begin with a brief discussion of overall demand patterns that appear consistently across all models.[xiv] We then turn to the gender-specific results associated with the above hypotheses. The relationship between IBLI uptake and price is statistically significant, but modest, with a decrease in probability of purchase of 0.1 per cent for every 1 per cent increase in price. Where included in the model, previous period purchase reduces the probability of purchase by 8.6 per cent. This result is sensible, given that the previous purchase period is 5-7 months prior to the current period and an IBLI insurance contract lasts 12 months. Therefore, those who purchased in the previous period are currently covered and,

assuming they understand the length of the coverage period, they would be less likely to purchase supplementary IBLI coverage. Coupon assignment increases the probability of purchase by 4.4 per cent, consistent with the assumptions that underpin its use as an instrument in the selection equation. Households that expect lower-than-normal rangeland conditions in the coming months are associated with a 3.5 per cent increase in the probability of IBLI purchase. Households with high livestock mortality in the previous period see a decrease in the probability of purchase of 3.5 per cent. In a society where livestock sales are a main source of liquidity, this points to liquidity constraints to access to IBLI.

Moving now to gender-specific results, column (1) represents a restricted regression that excludes all characteristics that vary visibly by gender in Table 3, as well as any characteristics that have the potential to vary systematically by gender. The average marginal effect (AME) of female-headed household in this restricted regression is not statistically significantly different from zero. This specification implicitly assumes that characteristics such as financial literacy, education or others that are excluded from this regression have no effect on the probability of IBLI purchase, so if there is any correlation between such variables and gender and the exclusionary assumption is false, the coefficient estimate on the gender variable would be biased. What this regression tells us is that when we include all of the various gender-related factors, whether mediated by other (currently omitted) characteristics or not, there is no variation in IBLI demand by gender. This is consistent with the proportionality of IBLI purchase by female-headed households to the number of female-headed households in the population.

Even if women's overall demand for IBLI is neither higher nor lower than men's, it is still possible that women's demand is driven at least partially by a different set of factors. Therefore, model (2) incorporates characteristics that we might expect to vary by gender and to influence IBLI uptake, either by shifting slopes or intercepts for women. Similarly, the percentage of income from livestock (scaled from 0-100) indicates that for every point increase in the share of income from livestock, the probability of purchasing IBLI decreases by a modest 0.1 per cent. The more livestock income one has, the less likely one is to purchase IBLI. This contradicts the idea that those who are more dependent on livestock income are more vulnerable to drought and would have higher demand for IBLI. This may

reflect the superior self-insurance capacity of those with the largest herds; they do not need insurance the way those with small or moderate herd sizes do. The statistical differences in mean shares of livestock income by gender (Table 3) could translate to a systematically lower likelihood of IBLI purchase by women driven by these initial differences, something we will explore briefly in the next section.

In model (2), we see no significant coefficient estimates on the interaction terms relating to product education, informal insurance and risk aversion and therefore fail to reject the null hypotheses that the average marginal effects are equal for men and women along these dimensions. However, the significant coefficient estimate on female-headed household suggests that there may be more to the story than is captured by our model. Simply being a female-headed household is associated with a 31.7 per cent increase in the probability of IBLI purchase, conditional on all observable factors that may differentially affect demand. An optimistic explanation is that women's sensitivity to risk, informal insurance and product education experiences are not fully captured by the variables included in the model, leaving women's perception of IBLI's risk reduction potential captured in the coefficient on female-headed household. A less optimistic, but perhaps more likely explanation is that, in a context where IBLI sales agents are paid on commission and all sales agents are men, women are more easily pressured to purchase.

Models (3) and (4) use a sub-sample of two decision maker households to test for a bargaining effect associated with female assets in the form of HS animals at marriage and current lactating herd proportion. We fail to reject the null that the average marginal effects of female asset holdings on IBLI uptake are equal for men and women. A modest, but statistically significant gender difference in the marginal effects of total cash and in-kind transfers on the probability of IBLI uptake of 0.4% is identified, suggesting that the relationship between informal insurance and IBLI may indeed differ between men and women. Either women are covered differently than men in ways that are not captured by the transfers variable, or women respond differently to informal insurance coverage than men do. The effect of transfers on men's demand for IBLI is very modestly negative and not statistically significantly different

from zero. For women, informal transfers appear to reduce demand for IBLI in a way that they do not for men.

Level of purchase results

Table 6 presents the effects of a range of factors on the level of IBLI coverage purchased, conditional on the inverse Mills ratio to control for prospective selection effects. Independent of gender, several general demand findings are worth mentioning. IBLI demand is price inelastic, with estimated elasticities in the range of -0.33 to -0.46. This is consistent with price elasticities identified in a separate study of IBLI demand in neighboring Marsabit, Kenya (Jensen et al., 2014). Age of household head is negatively associated with the level of purchase. As with the purchase decision model, there appears to be no gender variation in IBLI demand as indicated by the lack of significant coefficient on female-headed household in model (1).

As with the purchase decision estimation, model (2) incorporates all variables that potentially shift slopes or intercepts by gender. Unlike in the purchase decision model, here we do not see a significant marginal effect on female-headed household, suggesting that any effect related to sales agent pressure might be restricted to the decision to purchase and other factors drive the chosen level of coverage. A single point increase in the IBLI knowledge score is associated with a 4.1 per cent increase in TLU insured. Interestingly, the relationship between the education level of the household head and the level of IBLI purchase is negative, suggesting that each additional year of education is associated with a 5.1 per cent decrease in the TLU insured. If education and social status are correlated, this is consistent with the idea that lower status may result in vulnerability to pressure by educated, commission-motivated sales agents. This may reflect the gap between sales agents' education and household heads, both male and female, in Borana. This may lead those with less education relative to the sales agents, to purchase higher TLU coverage than they otherwise would, were they positioned differently in society. However, it is not clear why this effect would exist only for the level of purchase estimations.

A change of one standard deviation in non-livestock assets is associated with a 14 per cent decrease in TLU insured. One might think that households holding diverse assets are less vulnerable to the threat of livestock mortality due to drought when such assets tend to be related to non-pastoralist livelihoods. Yet at the same time one would not expect to see this effect operating through assets where estimates are conditioned on non-livestock income levels. In this case, proportion of income from livestock is included as a control and is not statistically significant, therefore we consider this result with caution.

When gender is interacted with variables of interest in models (2) and (3), we fail to reject the hypotheses that there are no gender differences in the relationships between IBLI demand and cash and in-kind transfers. Female asset holdings in the form of HS animals appear to have no gender-differentiated effect in model (3), unlike current lactating herd proportion in model (4) where we see a negative coefficient on the interaction term. This suggests that women in two-decision-maker households with more lactating animals have less incentive to insure, perhaps due to the increased ability to self-insure, combined with a better bargaining position. We do, however, reject the null that the average marginal effect of high risk aversion differs between men and women. The effect of high risk aversion on males, represented by the coefficient on high risk aversion alone, is positive but not statistically significantly different from zero. High risk aversion increases women's purchase of IBLI by 36 per cent compared to an equally risk averse man. Insurance demand theory suggests that as risk aversion increases, demand for insurance also increases. This effect disappears when we control for female assets brought into the marriage in model (3). Gender and moderate risk aversion appear to have a similar, but opposite effect in model (4), but again only weakly and in one specification. Lastly, in model (3) only we reject the null that the effect of home-centered information sources varies by gender, finding that women's IBLI purchase level is slightly more responsive (0.4%) to home-centered information than men's.

Discussion

Neither the IBLI purchase decision nor the level of IBLI coverage chosen demonstrate gender-differentiated demand when tested using the restricted regressions discussed above. Yet further analysis suggests that there are several pathways for gender-differentiated drivers of demand for IBLI, even if they do not amount to differences in demand outcomes. We first discuss gender differences in average marginal effects, and then discuss how differences in initial conditions may shape demand for women in relation to men.

Risk aversion appears to have an appreciably different effect on IBLI demand for women than for men, but the direction of the effect is ambiguous in the measures we use. Future improvements that incorporate risk aversion measures that are appropriate to the context and decision-making domain could contribute to understanding this gender difference. Better understanding of gender and the perceived risks associated with IBLI specifically is also essential. Qualitative respondents, who were mostly women, appeared to accept IBLI's risk-reducing claims at face value, while simultaneously maintaining a wait-and-see attitude toward initial or further purchase. Perceptions of IBLI as helpful were overwhelmingly positive (86%), despite no one having received an insurance payout. Some degree of response bias is likely, given that non-local IBLI staff were involved in qualitative data collection. As individuals learn about IBLI from experiences such as witnessing payouts or lack of payouts to themselves or their neighbors, understanding of the risks and benefits of the product will further develop. Post-payout data on these topics will be useful to understanding the relationship between risk-aversion and IBLI demand.

For women, informal insurance has a negative effect on the IBLI purchase decision that is modestly different from the effect for men with equal informal insurance coverage, as we have measured it. The nature and extent of coverage by informal risk management underpins the perceived benefits of IBLI relative to other risk management approaches and using total transfers may not adequately capture gender differences informal insurance coverage. Qualitative respondents stated unanimously that access to basic levels of informal risk management in the form of mutual assistance and reciprocity is driven by need rather than social connectedness or wealth. If need is defined by the household's material and labor resources, then it is captured in our model through herd size, income, assets and dependency ratio

controls. However, qualitative respondents described the extent of coverage provided by mutual assistance as a function of the 'good behavior' of the individual, defined as pro-social behaviors encompassing all manners of helping others to the best of one's ability given one's material and labor resources. Better understanding of the overall effect of informal insurance on IBLI uptake using data designed for such purposes will contribute to future understanding of any gender-differentiated effects.

I find some evidence of a gender-differentiated effect of home-based product information. This suggests that targeting marketing strategies to women through home-centered education may provide a gender-differentiated benefit, and further consideration of the means of education that women prefer would be needed if improved targeting of women is a goal. Considerable confusion among qualitative respondents regarding the definition of *insuraansii horrii* (IBLI) in the context of the product education module of the survey points to unusually high levels of random noise in this variable, which may limit statistical identification by attenuating any true effect.

I also find contradicting evidence of an intra-household bargaining effect associated with female assets — lactating animals and *horrii siiqqee* — despite the latter's local relevance. Though we cannot know for sure, the significance of lactating animals for women may be less indicative of bargaining than indicative of capacity to self-insure. If bargaining is not taking place around IBLI, this implies that gender-based targeting in two-adult households is not relevant to increasing access to IBLI in this context. Combined with the finding that female headed households are responsive to home-based information sources, this suggests that gender-based targeting could focus specifically on single-adult female headed households. However, given a significant body of evidence that contradicts the presence of identical preferences among household members, these findings point to a need for further exploration of intra-household decision making in Borana.[xv]

Even where AMEs do not differ, gender differences in averages of key characteristics may also play a role in gender-differentiated IBLI demand patterns. Proportion of income from livestock and age are, on average, lower and higher, respectively for women relative to men. Multiplying the statistically significant AMEs from Tables 6 and 7, we see that average differences in proportion of income from

livestock translate to a 2.8 per cent increased likelihood of IBLI purchase by women, while age differences account for a modest 0.5 per cent decrease in the same. No other characteristics with gender-differentiated averages had statistically significant effects on IBLI demand.

CONCLUSION

This paper provides an initial perspective on dimensions of demand for index based livestock insurance that might vary by gender, using a carefully conceptualized combination of data from a household survey, administrative records and structured qualitative interviews. Female-headed households purchase IBLI at the same rate as men, relative to their share of the population, yet the factors that drive women's demand appear to diverge slightly from men's. Econometrically, we reject the null hypothesis that the AMEs of risk aversion and informal insurance are equal to zero for the level of purchase and purchase decision models, respectively. The estimated average marginal effects of high risk aversion and informal insurance coverage have, respectively, positive and negative associations with IBLI demand by women. We reject the null that home-based product education have no gender-differentiated effect, and find that women are more responsive to home-based product education than men. We fail to reject the null that female HS assets have no gender-differentiated effects, a finding that contradicts much empirical evidence on intrahousehold bargaining. At the same time, we reject the null that female assets in the form of lactating animals have a gender-differentiated effect, which we interpret as a result of women's increased capacity to self-insure. We find that women's demand differs from men's due to differences in household head age and income shares from livestock. The largest gender-differentiated demand effects likely relate to women's lower social status, which is positively associated with the decision to purchase IBLI, possibly through women's vulnerability to pressure by sales agents. These results are consistent with Takahashi et al. (2015) whose gender control variables suggest that being female increases the likelihood of purchase, but not the level of coverage purchased.

In addition to aiding in econometric specification and interpretation, qualitative data suggest that variables used to understand information sources and informal insurance may not capture these concepts

precisely. Specifically, differences in informal insurance coverage and access may be driven by omitted variables reflecting pro-social behaviors and general confusion in terminology surrounding the IBLI product generate considerable noise in variables relating to the marketing experience of the household, such as IBLI information sources. A case is made for further investigation of the topic using data that captures difficult-to-observe dynamics that may underpin locally defined behavioral aspects of informal insurance access and gender differences in perceptions of IBLI's risk reduction potential, as well as ongoing reduction of measurement error in key variables such as IBLI information sources. Future findings can be leveraged to develop tools and strategies for ensuring that access to and benefits from innovative financial products are equitably distributed across the population.

Lastly, the negative effect of education on IBLI uptake, along with the strong and positive effect of being female, merits a closer look IBLI marketing and sales processes in order to understand whether the methods and strategies used encourage IBLI purchase induce a gender or other effect that inflates IBLI purchase based on social pressure rather than the product's potential to reduce risk and limit the effects of catastrophic drought. Employing sales strategies that encourage information-based choice to purchase IBLI will contribute to sustainable demand over the long term.

REFERENCES

Alderman, H., Chiappori, P.-A., Haddad, L., Hoddinott, J., & Kanbur, R. (1995). Unitary versus collective models of the household: is it time to shift the burden of proof? *World Bank Research Observer*, *10*(1), 1–19.

Banthia, A., Johnson, S., McCord, M. J., & Mathews, B. (2009). *Microinsurance that works for women: making gender-sensitive microinsurance programs*. ILO Microinsurance Innovation Facility.

Behrman, J. R. (1988). Intrahousehold Allocation of Nutrients in Rural India: Are Boys Favored? Do Parents Exhibit Inequality Aversion? *Oxford Economic Papers*, *40*(1), 32–54.

Bhattamishra, R., & Barrett, C. B. (2010). Community-Based Risk Management Arrangements: A Review. *World Development*, *38*(7), 923–932.

Chamberlain, G. (1980). Analysis of Covariance with Qualitative Data. *The Review of Economic Studies*, *47*(1), 225–238.

Chantarat, S., Mude, A. G., Barrett, C. B., & Carter, M. R. (2013). Designing Index-Based Livestock Insurance for Managing Asset Risk in Northern Kenya. *Journal of Risk and Insurance*, *80*(1), 205–237.

Chantarat, S., Mude, A., Barrett, C., & Turvey, C. (2009). The performance of index based livestock insurance: ex ante assessment in the presence of a poverty trap. *Available at SSRN 1844751*.

Chiappori, P. A., & Donni, O. (2009). Non-unitary models of household behavior: A survey of the literature. *IZA Discussion Papers*.

Cohen, M., & Sebstad, J. (2005). Reducing vulnerability: the demand for microinsurance. *Journal of International Development*, *17*(3), 397–474.

Coppock, D. L. (1994). *The Borana Plateau of Southern Ethiopia: Synthesis of Pastoral Research, Development and Change, 1980-91*. Addis Ababa.

Deere, C. D., & Doss, C. R. (2006). The Gender Asset Gap: What do we know and why does it matter? *Feminist Economics*, *12*(1-2), 1–50.

Dercon, S., & Hoddinott, J. (2005). Health, Shocks and Poverty Persistence. In S. Dercon, *Insurance Against Poverty* (pp. 124–136). Oxford: Oxford University Press.

Dercon, S., & Krishnan, P. (2000). In Sickness and in Health: Risk Sharing within Households in Rural Ethiopia. *Journal of Political Economy*, *108*(4), 688–727.

Eckel, C. C., & Grossman, P. J. (2008). Men, Women and Risk Aversion: Experimental Evidence. In *Handbook of Experimental Economics Results* (Vol. 1, pp. 1061–1073).

Fafchamps, M., & Quisumbing, A. R. (2002). Control and ownership of assets within rural Ethiopian households. *Journal of Development Studies*, *38*(6), 47–82.

Giné, X., Townsend, R., & Vickery, J. (2008). Patterns of Rainfall Insurance Participation in Rural India. *World Bank Economic Review*, *22*(3), 539–566.

Hertkorn, M.-L. (2013). *Borana Women in Livestock Management: The work of wives, girls, and widows, their perceptions and recent changes*. B.Sc. Thesis. University of Kassel.

Hill, R. V., Hoddinott, J., & Kumar, N. (2011). Adoption of Weather Index Insurance: Learning from Willingness to Pay Among a Panel of Households in Rural Ethiopia. *IFPRI Discussion Paper*.

Hoddinott, J. (2006). Shocks and their consequences across and within households in Rural Zimbabwe. *Journal of Development Studies*, *42*(2), 301–321.

Hoddinott, J., & Haddad, L. (1995). Does female income share influence household expenditures? Evidence from Côte d'Ivoire. *Oxford Bulletin of Economics and Statistics*, *57*(1), 77–96.

Hoddinott, J., & Kinsey, B. (2000). Adult health in the time of drought. *Food Consumption and Nutrition Division (FCND) Discussion Paper*, (79).

International Livestock Research Institute. (2014). *Index Based Livestock Insurance: Borana Household Survey Codebook*. (M. Ikegami & M. Sheahan)

Jensen, N. D., Mude, A. G., & Barrett, C. B. (2014) The role of basis risk and adverse selection in demand for index insurance: Evidence from northern Kenya. Working paper.

Lasage, R., Seifu, A., Hoogland, M., & de Vries, A. (2010). *Report on General Characteristics of the Borana Zone, Ethiopia* (pp. 1–36). Amsterdam: Institute for Environmental Studies.

Lybbert, T. J., Barrett, C. B., Desta, S., & Layne Coppock, D. (2004). Stochastic wealth dynamics and risk management among a poor population. *Economic Journal*, *114*(498), 750–777.

McPeak, J. (2006). Confronting the risk of asset loss: What role do livestock transfers in northern Kenya play? *Journal of Development Economics*, *81*(2), 415–437.

McPeak, J. G., & Doss, C. (2006). Are household production decisions cooperative? Evidence on pastoral migration and milk sales from Northern Kenya. *American Journal of Agricultural Economics*, *88*(3), 525–541.

McPeak, J., Little, P. D., & Doss, C. R. (2011). *Risk and Social Change in an African Rural Economy: Livelihoods in pastoralist communities* (Vol. 1). New York: Routledge.

Mobarak, A. M., & Rosenzweig, M. R. (2013). Informal Risk Sharing, Index Insurance, and Risk Taking in Developing Countries. *American Economic Review*, *103*(3), 375–380.

Morduch, J. (1999). Between the State and the Market: Can Informal Insurance Patch the Safety Net? *World Bank Research Observer*, *14*(2), 187–207.

Mundlak, Y. (1978). On the pooling of time series and cross section data. *Econometrica: Journal of the Econometric Society*, *46*(1), 69–85.

Quisumbing, A. R., & Maluccio, J. A. (2003). Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. *Oxford Bulletin of Economics and Statistics*, *65*(3), 283–327.

Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods*. SAGE Publications.

Rose, E. (1999). Consumption smoothing and excess female mortality in rural India. *Review of Economics and Statistics*, *81*(1), 41–49.

Santos, P., & Barrett, C. B. (2011). Persistent poverty and informal credit. *Journal of Development Economics*, *96*(2), 337–347.

Takahashi, K., Ikegami, M., Sheahan, M., & Barrett, C. B. (2014). Unpacking factors behind the (low) uptake of index-based insurance: Quasi-experimental evidence from livestock insurance in southern Ethiopia. *Working Paper*.

Thomas, D. (1990). Intra-household resource allocation: An inferential approach. *Journal of Human Resources*, 635–664.

Weber, E. U., Blais, A.-R. E., & Betz, N. E. (2002). A domain-specific risk-attitude scale: measuring risk perceptions and risk behaviors. *Journal of Behavioral Decision Making*, *15*(4), 263–290.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Yesuf, M., & Bluffstone, R. A. (2009). Poverty, Risk Aversion, and Path Dependence in Low-Income Countries: Experimental Evidence from Ethiopia. *American Journal of Agricultural Economics*, *91*(4), 1022–1037.

[i] NDVI images used in the construction of the IBLI contract has resolution of $8km^2$ and is taken every 10 days from a U.S. National Oceanic and Atmospheric Association satellite used largely for weather forecasting (Chantarat et al., 2013).

[ii] Note that reeras were not selected randomly and therefore cannot be said to be representative of the regional state, woredas or kebeles from which they were drawn. Reera-level population data outside of the selected reeras is not available.

[iii] Households were defined as 'a group of people who live in the same homestead (which may consist of more than a single dwelling) and share food and other items bought from a common household budget.' In the context of polygamous marriages, one husband can have multiple wives and each wife may or may not have a separate household (ILRI, 2014).

[iv] Rainfall data from Lasage et al., 2010.

[v] See Appendix A for further details on panel construction. See Appendix B for complete attrition analysis.

[vi] TLU, or tropical livestock units, are calculated based on metabolic weight. 1 TLU = 1 bovine = 0.7 camel = 10 sheep/goats.

[vii] The only exception was for participants in ILRI's annual herd migration survey, who had a 50 per cent chance of receiving a 100 per cent voucher for IBLI purchase up to 15 TLU. Only ten households received the 100 per cent voucher in a given sales period.

[viii] Unforseen changes in marital status and purchase behavior resulted in only 15 out of the intended 16 households being interviewed.

[ix] Four respondents had no household members participating in groups.

[x] According to the survey data, the most important information sources for both male- and female-headed households were community meetings and NGOs, followed by the insurance company and informal conversations with friends and family. Qualitative data contradict this. All respondents who attended community meetings where IBLI was discussed reported not effectively learning about the IBLI product at community meetings. No one reported community meetings as a preferred channel, though for many people they were the only product-focused channel, which may explain why this was chosen as 'most important' in the survey data. No one indicated that they learned about the IBLI product from informal conversations with friends and family. The category 'NGO' meant different things to different people, including ILRI, OIC or anyone who comes to the community in a car.

[xi] The effective price of IBLI per TLU of coverage, accounts for discount coupons received in addition to spatial and temporal price variations. However, IBLI is priced by species, not TLU. Therefore, the price facing each individual depends on the animals they choose to insure. For simplicity, we have calculated the effective TLU price as the price of insuring one cow rather than using the actual prices paid for the diverse combinations of animals individuals chose to insure. The latter method makes it difficult to define a price for those who chose not to purchase IBLI.

[xii] First-stage regressions of IBLI knowledge on assigned cartoon and assigned tape for the time period used in this study yield p-values ranging from 0.05-0.88, depending on the specification. In their study of IBLI demand using the same data, but only the first two sales periods, Takahashi et al (2015) instrument for IBLI knowledge using the educational treatments. Their first-stage regressions suggest that the instrument is weak in the first purchase period, but acceptable in the second. Given that these interventions were only used in the first year of IBLI implementation, it is sensible that their influence on knowledge wanes over time and is not visible in the third and fourth purchase periods.

[xiii] The first indemnity payments under the IBLI contracts were made in November 2014, outside the time span of the data analyzed here.

[xiv] These results are consistent across all specifications, including those using reported IBLI purchase rather than OIC record of purchase. Those results can be found in Appendix D.

[xv] Empirical tests of intrahousehold bargaining following Thomas (1990) reveal non-identical preferences across several household expenditure classes (sugar, tobacco, cooking fuel, and education) using lactating herd and HS animals. These results are reported in Appendix D, Table D5.

TABLES AND FIGURES

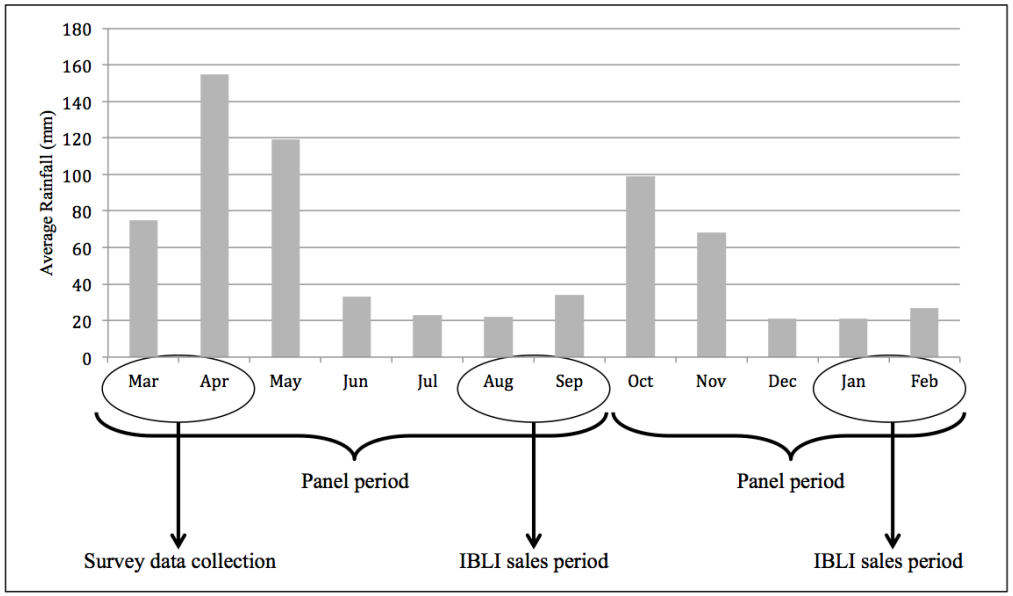

Figure 1: Seasonal Survey Structure

Table 1: IBLI Information Sources

Product-focused channels	Home-centered channels	Neither	Prevalence (%)
OIC staff			11.8%
Television			1.2%
Posters			4.6%
Cooperatives/Network Groups			3.7%
Community meetings			49.2%
Radio	Radio		4.3%
DAs (cartoon/tape)	DAs (cartoon/tape)		37.1%
	ILRI household survey		76.2%
	NGOs		1.6%
	Neighbors, friends and relatives		52.9%
		Discount coupon distribution	50.1%
		DAs (non-cartoon/tape)	64.8%

Table 2: Panel Household Characteristics

		Frequency	Per cent
Head Gender	Female Head	97	20.9
	Male Head	367	79.1
	Total	*464*	*100.0*
Marital Status of Female Heads	Never married	2	2.1
	Married	19	19.6
	Divorced/separated	8	8.2
	Widowed	68	70.1
	Total	*97*	*100.0*
Ethnic Group	Borana	427	92.0
	Guji	36	7.8
	Gabra	1	0.2
	Total	*464*	*100.0*
Religion	Traditional	385	83.0
	Muslim	18	3.9
	Orthodox	1	0.2
	Protestant	42	9.1
	Catholic	7	1.5
	Other Christian	11	2.4
	Total	*464*	*100.0*
Settlement Status	Fully Settled	356	76.7
	Partially Settled	72	15.5
	Nomadic	36	7.8
	Total	*464*	*100.0*

Table 3: Panel Household Characteristics Disaggregated by Gender of Household Head (R3)

	Aggregate		Male Head		Female Head		Differences	
	Mean	SD	Mean	SD	Mean	SD	Male-Fem	(t-stat)
Herd size (TLU)	18.43	25.87	20.63	27.61	10.00	15.08	10.6***	(5.22)
Total Income (ETB)	3,750.00	5,853.00	4,122.00	6,233.00	2,328.00	3,780.00	1794.2***	(3.68)
Cash Income (ETB)	357.40	3,397.00	361.70	3,677.00	340.80	2,009.00	20.9	(0.077)
Proportion of income from livestock	81.82	28.93	84.71	25.73	70.77	36.93	13.9***	(3.61)
Cash Savings (ETB)	1,493.00	9,791.00	1,709.00	10,802.00	669.40	3,986.00	1039.8	(1.55)
Asset Index	0.00	1.00	0.04	1.04	(0.15)	0.83	0.19	(1.91)
All Transfers	237.80	317.30	257.20	341.60	163.70	181.60	93.5***	(3.76)
Network Groups	0.96	0.93	1.05	0.95	0.62	0.77	0.42***	(4.74)
Education	3.29	3.13	3.32	3.16	3.16	3.04	0.16	(0.45)
Household Head Education	0.52	1.84	0.62	2.02	0.15	0.85	0.47***	(3.46)
Financial Literacy	4.16	1.27	4.26	1.19	3.78	1.50	0.48**	(2.98)
Age of Head	51.78	17.96	50.81	17.72	55.53	18.48	-4.72*	(-2.32)
Household Size	7.28	2.81	7.69	2.83	5.70	2.11	1.99***	(7.88)
Dependency ratio	1.39	0.87	1.35	0.74	1.54	1.24	-0.20	(-1.53)
Low risk aversion	0.39	0.49	0.39	0.49	0.41	0.49	-0.019	(-0.36)
Moderate risk aversion	0.43	0.50	0.43	0.50	0.45	0.50	-0.020	(-0.37)
High risk aversion	0.18	0.38	0.19	0.39	0.15	0.35	0.040	(0.99)
Expected rangeland below normal	0.46	0.50	0.45	0.50	0.49	0.50	-0.031	(-0.56)
Expected rangeland normal	0.30	0.46	0.30	0.46	0.30	0.46	-0.0040	(-0.079)
Expected rangeland above normal	0.24	0.43	0.25	0.43	0.21	0.41	0.035	(0.76)
Home-Centered Info Sources	37.22	20.00	37.59	19.67	35.81	21.26	1.78	(0.77)
IBLI Knowledge	4.91	1.80	4.96	1.82	4.73	1.72	0.23	(1.21)
Effective price per TLU	280.00	134.00	281.60	132.10	273.60	141.40	8.00	(0.52)
IBLI Purchase --Reported	0.30	0.46	0.30	0.46	0.30	0.46	-0.0015	(-0.029)
IBLI Purchase--OIC	0.08	0.27	0.08	0.27	0.08	0.27	-0.0015	(-0.051)
TLU Insured—Reported (n=149)	2.49	5.07	2.87	5.62	1.05	0.99	1.19	(1.79)
TLU Insured--OIC (n=38)	4.41	6.26	4.96	6.49	2.33	5.16	2.64	(1.06)
Percent herd insured--Reported (n=149)	0.03	0.14	0.03	0.16	0.03	0.09	0.00006	(0.0021)
Percent herd insured--OIC (n=38)	0.28	0.42	0.28	0.45	0.29	0.33	-0.0124	(-0.0072)
Observations	497		394		103		497	

* p<0.05, ** p<0.01, *** p<0.001

Table 4: Differences Between Purchasers and Non-Purchasers, and Purchasers By Gender (OIC Records)

	Aggregate		Female		Purchasers by Gender	
	Purch - Non	t-statistic	Purch - Non	t-statistic	Male-Female	t-statistic
Herd size (TLU)	6.28**	(2.85)	-0.96	(-0.63)	18.8***	(6.43)
Total Income (ETB)	-351.3	(-1.48)	45.9	(0.14)	1174.7**	(3.05)
Cash Income (ETB)	-52.8	(-0.80)	-91.4	(-0.85)	69.5	(0.82)
Proportion of income from livestock	-7.66***	(-3.55)	-0.0043	(-0.0009)	3.99	(0.78)
Cash Savings (ETB)	3018.6	(1.89)	243.3	(0.39)	4515.7*	(2.17)
Asset Index	-0.077**	(-2.79)	-0.091*	(-2.28)	0.11***	(3.52)
Total Value of Transfers	21.0	(0.27)	-57.6*	(-2.41)	173.6	(1.76)
Network Groups	0.10	(1.90)	-0.010	(-0.13)	0.53***	(5.77)
Education	0.21	(1.09)	0.46	(1.05)	-0.024	(-0.052)
Household Head Education	-0.15	(-1.44)	0.075	(0.58)	0.26	(1.57)
Financial Literacy	0.17*	(2.21)	0.17	(0.85)	0.51**	(2.68)
Age of Head	-1.10	(-1.03)	-4.86	(-1.94)	-1.21	(-0.48)
Household Size	-0.26	(-1.68)	-0.077	(-0.32)	1.69***	(6.36)
Dependency ratio	0.0082	(0.14)	0.087	(0.47)	-0.43*	(-2.45)
Low risk aversion	0.077*	(2.51)	0.12	(1.78)	-0.059	(-0.86)
Moderate risk aversion	-0.020	(-0.67)	-0.082	(-1.25)	0.057	(0.85)
High risk aversion	-0.056**	(-2.89)	-0.037	(-0.89)	0.0019	(0.045)
Expected rangeland below normal	0.077*	(2.50)	0.048	(0.71)	0.073	(1.06)
Expected rangeland normal	-0.035	(-1.33)	-0.033	(-0.56)	-0.012	(-0.20)
Expected rangeland above normal	-0.041	(-1.65)	-0.015	(-0.26)	-0.060	(-1.03)
Total IBLI Info Sources	0.18	(1.86)	0.26	(1.49)	0.31	(1.68)
Home-Centered Info Sources	2.57*	(2.00)	1.34	(0.48)	1.30	(0.47)
IBLI Knowledge	0.52***	(5.27)	0.74***	(3.63)	0.013	(0.062)
Effective price per TLU	-93.8***	(-11.2)	-68.7***	(-4.55)	-26.3	(-1.63)
IBLI Purchase—Reported					0.0038	(0.068)
TLU Insured—Reported					1.25***	(4.67)
TLU Insured—OIC Records					2.39***	(5.91)
Percent of herd insured--Reported					-0.27	(-0.93)
Percent of herd insured--OIC Records					-0.27	(-0.90)
Observations	1940		404		316	

* p<0.05 ** p<0.01 *** p<0.001

Table 5: IBLI Purchase Decision

	(1)	(2)	(3)	(4)
Female headed household	0.069	0.317***	0.552**	0.481**
	(0.159)	(0.123)	(0.223)	(0.207)
Female Head X HS at marriage			-0.127	
			(0.086)	
HS at marriage			0.015	
			(0.021)	
Female Head X Lactating herd				-0.083
				(0.093)
ln Lactating herd proportion				-0.021
				(0.020)
Female Head X Home info		-0.0002	0.001	0.001
		(0.0007)	(0.001)	(0.001)
Home-centered information		0.0004	0.001	0.001
		(0.0005)	(0.001)	(0.001)
Female Head X Transfers		-0.001	-0.043**	-0.042**
		(0.009)	(0.021)	(0.021)
ln Transfers		-0.006	-0.005	-0.005
		(0.005)	(0.005)	(0.005)
Female Head X Moderate risk aversion		-0.019	-0.060	-0.027
		(0.030)	(0.060)	(0.059)
Moderate risk aversion		0.007	0.007	0.007
		(0.015)	(0.015)	(0.015)
Female Head X High risk aversion		-0.046	-0.021	-0.157
		(0.050)	(0.155)	(0.156)
High risk aversion		0.004	-0.111	-0.113
		(0.684)	(0.704)	(0.698)
ln Effective price per TLU	-0.117***	-0.086***	-0.093***	-0.091***
	(0.017)	(0.013)	(0.015)	(0.015)
Lagged IBLI purchase		-0.191***	-0.179***	-0.181***
		(0.024)	(0.026)	(0.026)
Dependency ratio	0.005	-0.012	-0.047**	-0.046**
	(0.009)	(0.016)	(0.023)	(0.023)
Expected rangeland below normal	0.069**	0.035*	0.026	0.028
	(0.029)	(0.020)	(0.023)	(0.022)
ln Previous period losses (TLU)	-0.016	-0.035***	-0.042***	-0.043***
	(0.016)	(0.014)	(0.015)	(0.015)
Assigned coupon	0.063**	0.044**	0.031	0.032
	(0.030)	(0.021)	(0.022)	(0.022)
Age of household head		-0.061***	-0.060**	-0.058**
		(0.019)	(0.023)	(0.023)
Age squared		0.0004***	0.0004**	0.0004**
		(0.00016)	(0.00019)	(0.00019)
Proportion of income from livestock		-0.001***	-0.001**	-0.001**
		(0.000)	(0.000)	(0.000)
Household Average Controls	HAC1	HAC2	HAC2	HAC2
Observations	1,824	1,824	1,510	1,526
LR Chi2	252.93	706.9	703.71	709.26
Prob > Chi2	0.000	0.000	0.000	0.000

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The following coefficients are non-significant and not reported: Savings, non-livestock assets, income, herd size, head education, financial literacy, IBLI knowledge and expected rangeland above normal. HAC1 includes dependency ratio, expected rangeland conditions and effective price. HAC2 contains head age and age-squared, non-livestock assets, income, proportion of income from livestock, cash savings, previous period purchase, effective price, IBLI knowledge and all HAC1.

Table 6: Level of IBLI Purchase

	(1)	(2)	(3)	(4)
Female headed household	0.100	0.144	-0.057	0.233
	(0.408)	(0.454)	(0.731)	(0.676)
Female Head X HS at marriage			0.286	
			(0.364)	
HS at marriage			-0.038	
			(0.070)	
Female Head X Lactating herd				-0.710*
				(0.408)
ln Lactating herd proportion				0.169**
				(0.077)
Female Head X Home info		-0.003	0.002	0.003
		(0.003)	(0.007)	(0.007)
Home-centered information		0.003	0.004*	0.003
		(0.002)	(0.002)	(0.002)
Female Head X Transfers		-0.015	0.001	0.013
		(0.037)	(0.071)	(0.070)
ln Transfers		0.024	0.020	0.020
		(0.021)	(0.022)	(0.021)
Female Head X Moderate risk aversion		-0.104	-0.287	-0.407*
		(0.128)	(0.236)	(0.225)
Moderate risk aversion		-0.021	-0.035	-0.034
		(0.058)	(0.058)	(0.057)
Female Head X High risk aversion		0.358*	-0.566	-0.104
		(0.208)	(0.784)	(0.493)
High risk aversion		0.138	1.234	1.002
		(2.914)	(2.932)	(2.884)
IBLI knowledge		0.041*	0.048*	0.042
		(0.025)	(0.027)	(0.027)
Head Education		-0.051***	-0.056***	-0.051***
		(0.016)	(0.017)	(0.017)
ln Effective price per TLU	-0.463***	-0.327***	-0.347***	-0.350***
	(0.072)	(0.035)	(0.032)	(0.032)
Lagged IBLI purchase		0.015	-0.024	-0.035
		(0.095)	(0.092)	(0.091)
Age of household head		-0.005	-0.073	-0.148*
		(0.067)	(0.086)	(0.087)
Age squared		0.0002	0.001	0.001*
		(0.001)	(0.001)	(0.001)
Asset Index		-0.139*	-0.188**	-0.165**
		(0.076)	(0.079)	(0.078)
lambda	0.341	-0.134	-0.09	-0.091
	(0.219)	(0.084)	(0.067)	(0.065)
Constant	3.008***	3.330***	3.421***	3.640***
	(0.217)	(0.545)	(0.592)	(0.589)
Household Average Controls	HAC1	HAC2	HAC2	HAC2
Observations	1,824	1,824	1,510	1,526
Chi2	328.7	861.7	855.6	888.8
Prob >Chi2	0.000	0.000	0.000	0.000

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The following coefficients are non-significant and not reported: Financial literacy, expected rangeland conditions, previous period losses, proportion of income from livestock,(ln) herd size, dependency ratio, cash savings, (ln) income. HAC1 includes dependency ratio, expected rangeland conditions and effective price. HAC2 contains head age and age-squared, non-livestock assets, income, proportion of income from livestock, cash savings, previous period purchase, effective price, IBLI knowledge and all HAC1.

APPENDIX A: Panel and Variable Construction

Panel Structure

The Borana household data are collected annually, but the structure of the questionnaire involves seasonal recall for many variables of interest to this analysis. Seasonal recall uses four seasons: long rain, long dry, short rain and short dry, which we combine into long rain + long dry (LRLD) and short rain + short dry (SRSD). The IBLI purchase periods are in August/September and January/February, at the end of each SRSD and LRLD period. The panel is analyzed by period, but data are collected by "round" as described in Table A1. Variables that are not collected using the seasonal recall structure, require an assumption to be made based on the nature of the variable in order to determine the value at the intermediate period. Any assumptions and other information about variable construction are described in detail below.

Table A1: Panel Structure

Time Period	Season	Period (P)	Round (R)
March-Sept 2012	LRLD	P1	
Oct 2011-Feb 2012	SRSD	P2	R1
March-Sept 2012	LRLD	P3	
Oct-Feb 2013	SRSD	P4	R2
March-Sept 2013	LRLD	P5	
Oct 2013-Feb 2014	SRSD	P6	R3

Gender of Household Head

The gender of the household head is virtually time invariant in the current data, with the exception of six observations where the gender of the household head changed. For these we chose to use the within-household mode, which also happened to be the gender of the household head at the time that IBLI was introduced.

Marital Status

Marital status is collected using five categories: Never married, married, consensual partner, divorced and widowed. From the point of view of our analysis, consensual partnership (n=4) is functionally equivalent to marriage in that it creates a dual decision maker household, therefore we merged the consensual partner category with the married category. This allows consensual partner households to be included in dual decision maker analyses. Marital status for P1, P3 and P5 are assumed to be the same as P2, P4 and P6, respectively.

During data collection at P6, extra care was taken in collecting marital status data. Households headed by widows often reported that they were married. These errors were corrected in previous rounds by analyzing household member deaths. For households where the husband died in a previous round, the wife's marital status was adjusted to widowed after that point and married before. For households where there was no record of the husband's death, the death was assumed to have happened prior to survey implementation and therefore the wife's marital status was adjusted to widowed for all survey periods.

Herd Size

The size and species composition of animals herded by the household was collected at P2, P4 and P6, along with seasonal mortality, birth, offtake and slaughter information. This information is used to calculate the P1, P3 and P5 values for these variables. Herd information is then converted to Tropical Livestock Units (TLU) based on species metabolic weight to allow for aggregation across species. Borrowing from previous researchers in this area, 1 TLU = 1 bovine = 0.7 camel = 10 sheep/goats (McPeak et al. 2011, Lybbert et al. 2004, Jensen et al. 2014).

Total Income

Income is calculated as monthly average cash and in-kind income and includes labor market participation, milk production, livestock sales, livestock slaughters, aid and cash income from other sources. Total income excludes informal cash and in-kind transfers.

Daily average milk production per animal was valued using average market prices by species and season reported by households that sold milk. Price data were too sparse to calculate prices by each of the four seasons, so two seasonal sets of prices—dry and rainy—were used. This daily average milk value was then multiplied by 30.4 (average days per month) to get monthly average milk income.

Livestock that was sold and slaughtered was valued at median sale price by species and rainy/dry season. Similar to milk prices, livestock sales data were too sparse across all 16 season/species combinations, we aggregated seasonal prices into dry and rainy season prices. Given high variance in reported prices and the presence of extreme outliers, we opted to use median season/species prices. We then estimated the animal sales revenue using transactions that were reported as sales, excluding gifts, loans and repayment of debts. While these non-sale transactions most certainly have value to households, assigning monetary values to these cases is problematic. Some of these activities are captured in the livestock transfers variable. The estimated prices ignore animal age, quality, and sex that are likely determinants of price but that we cannot capture. The alternative is to use prices as reported by households for livestock sales, but the problem of valuing slaughtered animals remains. The argument for using reported prices is that they may be more likely to correspond to the market value of the specific animals sold better than mean or median prices.

Income from aid was reported by respondents as average monthly values of supplementary feeding, food aid and other aid. Respondents identified the number of months in the previous year that they received these three types of aid, which was then multiplied by the monthly value to get a yearly value of aid. This yearly value was apportioned to the panel periods by the number of months in the period and that value was used to create an average monthly value for each panel period.

Cash income is calculated using respondent recall of income and income source by season (panel period). Seasons are then divided by the number of months therein to obtain monthly average cash income for corresponding periods. All income is included except that from sale of livestock, sale of milk and NGO work. This income should be captured in milk, offtake and other assistance sections of the survey.

Cash Savings

Cash savings are reported by respondents in P2, P4 and P6, but there are no data on savings fluctuations between these periods, making it difficult to determine an appropriate value for P1 and P3. Currently, total savings data are only used descriptively and not in panel analysis. In the panel analysis, we use a dummy variable to represent having enough savings to insure five cattle. For P1, P3 and P5 we use the P2, P4 and P6 values of this dummy variable.

Asset Index

The asset index is constructed using principal components analysis on 58 non-livestock durable goods. Each item is listed in Table A2, along with the associated factor loadings for each survey round. Each variable is a count of the number of that item owned by household. Items for which there was zero ownership and/or zero variance, such as motorcycles and satellite dishes, were excluded. Complete stock of durable goods and housing amenities was taken at P2 and changes were collected at P4 and P6, allowing for calculation of P4 and P6 stocks. Any recall error at P4 will carry over to P6. For now, values for P1, P3 and P5 are assumed to be the same as P2, P4 and P6, respectively, though there is little basis for this assumption besides convenience. The assets section is one of the more tedious sections of the survey and is poorly tailored to the Borana context. Both enumerators and respondents regularly expressed frustration with the assets module. The stocks and flows nature of the data collection strategy creates potential for measurement error from previous periods to carry through to current periods and to accumulate over time.

Table A2: PCA Factor Loadings

Asset	P1/P2	P3/P4	P5/P6
Animal Bell	0.303	0.609	0.233
Animal Cart	-0.135	.	0.217
Anvil	0.080	0.215	.
Axe	0.401	0.922	0.431
Barbering Items	0.399	0.642	0.013
Basin	0.400	0.855	0.207
Beads	0.249	0.628	0.114
Bedframe	-0.001	.	-0.021

Bicycle	0.192	.	.
Box or Trunk	0.380	0.673	0.199
Brickmold	0.256	0.215	0.467
Bucket	0.317	0.332	.
Mobile Phone	0.436	0.603	0.061
Chair	0.282	.	0.244
Hammer	0.318	0.147	0.064
Cup	0.006	0.944	0.570
Dresser	0.220	.	.
Gourd	0.173	0.915	0.704
Grinding Mill	0.208	0.370	0.227
Traditional Healer Items	-0.063	.	0.000
Hides or Pelts	0.064	0.910	0.498
Hoe	0.264	0.470	0.421
Jerrycan	0.287	0.965	0.689
Jewelry	0.107	0.303	0.104
Knife	0.339	0.945	0.264
Machete	0.257	0.540	0.143
Mat	0.121	0.160	0.499
Mattress	0.492	0.425	0.290
Mosquito Net	0.328	0.824	0.075
Motorcycle	0.153	.	0.060
Natural Bed	0.120	0.808	0.590
Oven	0.056	.	.
Pannier	0.392	0.376	0.471
Paraffin Lamp	0.334	0.331	0.079
Pickaxe	0.337	0.507	0.333
Plow	0.209	0.593	0.173
Chisel	0.367	0.640	0.513
Radio	0.331	0.358	0.134
Shelves	0.167	0.353	0.094
Shop	0.192	.	0.019
Sickle	0.466	0.481	0.251
Sofa	0.120	.	.
Spade	0.428	0.589	0.344
Spear or Club	0.307	0.553	0.381
Stocks	.	.	-0.009
Stall	-0.107	.	.
Stool	0.095	0.959	0.775
Natural Stove	0.197	0.254	-0.032
Kerosene Stove	-0.073	.	.
Cooking Pot	0.243	0.969	0.684
Table	0.050	.	-0.016
Television	0.077	.	.
Thermos	0.268	0.350	0.195
Till	0.064	.	.
Wardrobe	0.208	.	0.099
Watch	0.363	0.356	0.329
Water Drum	-0.130	0.263	.
Wheelbarrow	0.150	.	-0.038

Where loading is missing, variable was dropped due to limited variance in that survey round.

Cash and In-kind Transfers Received and Given

Transfers data are reported by respondents using the seasonal recall structure, allowing for calculation of season-specific values for all periods, which are then divided by the number of months in the period to create monthly averages for transfers received and transfers given. In regressions, transfers are represented as the total of the absolute values of transfers in both directions.

Education

Education is education level of the household head, in years. Through grade 12, each grade corresponds to one year. Beyond that, education levels were re-scaled to correspond to the number of years of education associated with each level of attainment. Education data are collected in full at P2, and then only information on household members who enter and leave school are collected in later periods. To calculate the attainment of an individual, one must make an assumption about whether individuals in school advance to the next grade. We assume that all individuals advance every year they are in school. Educational attainment of the household head for P1, P3 and P5 are assumed to be the same as P2, P4 and P6, respectively

Financial Literacy

Financial literacy is the number of correct answers to the seven questions listed below. Financial literacy data were collected only at baseline and is treated as a time-invariant characteristic.

- *If you have 6 female goats and 3 male goats, how many goats do you have in total?*
- *If you have 4 cattle subherds with each subherd with 5 animals, how many animals do you have in total?*
- *If you have 400 goats and subdivide then into 10 equal subherds, how many goats are in each subherd?*
- *I will read the following digits. Please listen to me, memorize it, and tell me the number: 369219?*

- *Suppose you want to borrow some money, and you have to pay back Birr 10 for every Birr 100 that you borrow. This is called interest rate. Are you familiar with this concept?*
- *Suppose you borrow Birr 100 , and you have to pay back Birr 10 every month for every Birr 100 that you borrow. If you have not repaid any of the total for a period of three months, how much do you owe at the end of the 3 months?*
- *Suppose you need to borrow Birr 500. Two people offer you a loan. One requires you to pay back Birr 600 in a month. The second requires you to pay back Birr 500 plus Birr 15 for every Birr 100 you borrow that month. Which loan represents a better deal for you?*

Dependency Ratio

The dependency ratio is calculated as the number of dependents divided by the number of adults. Children are defined as those aged 15 and under, while adults are defined as those older than 15. We omitted elderly dependents due to suspected age inflation in the right tail. Including elderly dependents created households without adults. Ages for P1, P3 and P5 are assumed to be equal to P2, P4 and P6, respectively.

Household Size

Household size is a simple count of the number of members listed in the household roster. We do not have data on household size fluctuation between survey rounds and we assume that household sizes at P1, P3 and P5 are equal to P2, P4 and P6, respectively.

Risk Aversion

Risk aversion is measured at baseline using a coin toss gamble where risk and return are positively correlated. The respondent is presented with the following introduction:

Let me introduce you to a lottery, whose value depends on the outcome of a coin. We am going to flip a coin. In each lottery, if the coin lands on head, you will win the amount below the picture of the head. If the coin lands on a tail, you will win the amount below the picture of tail of this coin….I now offer a chance for you to choose one of the six lotteries displayed in the next image, which may allow you to earn from 0 to 200 ETB, depending on your choice of lottery and your luck. The total amount of reward you will get will depend on the outcome of the lottery you choose, which will depend on the outcome of the coin that I'm going to flip. (ILRI 2014)

The respondent is then shown a series of six images of head and tail sides of an Ethiopian coin and associated amounts of money and is asked to choose. The six gambles are displayed in Table A3. Using these data, we created a set of binary variables by combining the two highest, middle and lowest choice numbers to represent low, moderate and high risk aversion, respectively.

Table A3: Risk Preference Experiment Choices

Choice Number	Heads Amount (ETB)	Tails Amount (ETB)	Risk Aversion Classification
0	50	50	High
1	45	95	High
2	40	120	Medium
3	30	150	Medium
4	10	190	Low
5	0	200	Low

IBLI Information Sources

Information was collected at P4 on whether individuals heard about IBLI through specific information sources. These sources are: neighbors, friends and relatives in informal groups; development agents or other government officials; community meetings; the survey conducted by ILRI; discount coupons; cartoons; poet tapes; radio; television; posters; Oromia Insurance Company (OIC) staff and/or Oromia Savings and Credit Share Company; NGO staff; network groups; other. Given confusion about this question that was noticed during the qualitative phase of research, this variable was structured the

percentage of total information sources that were home-centered, that is, information sources that potentially educate about IBLI that are accessible from home. This percentage is expressed as whole numbers between 0 and 100 to aid in interpretation. The number of information sources at P3 and P5 are assumed to be the same as at P4 and P6.

IBLI Knowledge

The IBLI knowledge variable is constructed using a count of correct answers to the following eight questions:

- *Based on your understanding of the livestock insurance, how often do you have to pay a premium in order to remain insured?*
- *If you did not receive indemnity payout (compensation) from the livestock insurance, would you expect to receive your premium back?*
- *When you receive an indemnity payment (compensation) in what form do you expect to receive it in?*
- *Based on your understanding of the livestock insurance, under what conditions do you expect indemnity payout (compensation)?*
- *Suppose that you had insured 10,000 Birr of cows. What is the maximum indemnity payment that you can receive after a worse drought?*
- *What institution will provide you indemnity payout in October 2013 if there is a payout?*
- *Boru insured 10 cattle by IBLI. There was no drought but Boru lost 8 cattle due to disease outbreak. Will Boru receive indemnity payout?*
- *Godana has decided to purchase IBLI for 1 cattle, 1 camel and 1 shoat among his herds. Will Godana pay different amount of premium for all the three species of animals?*

These questions are asked only at P4 and P6, so values for P3 and P5 are assumed equal to P4 and P6 values.

Lactating Herd

The number and species of lactating animals is collected as part of the survey. However, the survey doesn't capture herd dynamics (birth, death, offtake, slaughter) by animal sex, so we cannot compute lactating animals for P1, P3 and P5 directly. Therefore these values are assumed to be the same as P2, P4 and P6 respectively. Lactating animals are aggregated using TLU in order to at least partially capture the differences in milk production volume between species. However, TLU conversions are not designed specifically for lactating animals, which may have profoundly different metabolic processes.

Horrii Siiqqee Animals

Horrii siiqqee (HS) animals are cattle that are transferred to a newly married couple from the bride's household. Current HS stocks were collected at P6, along with information on birth, death, offtake and slaughter of HS animals in the preceding year. Flows information was used to back out HS values for P4 and P5. Additionally, HS stocks at the time of marriage were collected for all ever-married households. All HS values are converted to percentage of total cattle herd.

Effective Price

The effective price of IBLI is designed to capture as accurately as possible the actual price faced by the individual consumer. The price of IBLI varies by species, geographic location (woreda) and discount coupon amount. Coupons offer a percentage discount on IBLI purchase up to the first 15 TLU of livestock purchased. However, IBLI is priced by species and not by TLU and effective price must be in price per TLU in order to allow for aggregated analysis across species. One approach is to use the actual prices paid by those who purchased IBLI on various combinations of animal species, but we would still have to transform those prices into a price per TLU and would still have no straightforward way of

defining a price for non-purchasers. We chose to calculate the effective TLU price as the price per animal for the first 15 cattle using the woreda-level IBLI cattle prices minus any discount coupon received by the household. Woreda-level IBLI prices remain relatively constant throughout the survey periods, while coupons are distributed in advance of each sales period. This allows for calculation of effective price for all panel periods.

Share of Income from Livestock

The share of income from livestock is defined as income from milk, offtake and slaughter divided by total income and is calculated for all panel periods. It is expressed as a number from 0-100 to aid in interpretation of results.

Losses in Previous Period

Previous period losses are the lagged values of livestock mortality as reported by respondents. Because this information is reported seasonally, no assumptions were needed to complete the panel.

Expected Rangeland Conditions

Respondents are asked about their expectation for the coming (long) rainy season and rangeland condition. Their responses are scaled so that 1=much below normal, 3=normal and 5=much above normal. We then created a set of dummy variables representing above normal, normal and below normal, with normal as the omitted category in regressions. Expected conditions for P1, P3 and P5 are assumed equal to P2, P4 and P6.

APPENDIX B: Attrition Analysis

Ten per cent of the original survey sample attritted over the three survey rounds. We used two approaches to testing for systematic attrition—simple means tests on key observables and a logistic regression using a binary variable representing whether a household was retained in the panel or lost to attrition. Means tests using the main sample used for purchase decision regressions suggest that multiple variables are different between panel and non-panel households, as reported in column (1) of Table 1B. However, means differences disappear when multivariate methods are used. So in column (2) we report the logit estimates of the binary variable that the household attritted. The logit model demonstrates that attrition is not systematic once we condition on key variables. Similar to the main sample, univariate means tests, reported in column (3) show significant differences. The logit of attrition within the bargaining subsample of two decision maker households, reported in column (4), shows gender and wealth related attrition patterns, which are not surprising given that households with two married adults have different dependency ratios and productive capacity than single-adult households. Marital status is also a significant predictor of attrition, which makes sense since being married and having two decision makers in the household are highly correlated. Overall, attrition does not appear to be of concern to the main estimation results, and bargaining results need to be interpreted with attrition patterns in mind.

Table 1B: Attrition Analysis

	Main Sample		Bargaining Sample	
	(1)	(2)	(3)	(4)
Female-headed household	0.152	-0.00520	0.660***	-0.0488
	(1.97)	(0.00607)	(15.52)	(0.0522)
Married=1/Nonmarried=0	0.022	-0.00935	-0.635***	0.432***
	(0.39)	(0.0102)	(-14.49)	(0.118)
Moderate risk aversion	-0.005	-0.00361	-0.019	-0.0557*
	(-0.06)	(0.00401)	(-0.37)	(0.0327)
High risk aversion	-0.054	0.0180	-0.008	0.0369
	(-1.25)	(0.0136)	(-0.23)	(0.0602)
ln Total Transfers	-2.420***	0.00525	-1.215***	0.0988***
	(-5.89)	(0.00530)	(-6.74)	(0.0273)
Financial literacy	-0.272	0.000430	-0.622***	0.0308**
	(-1.26)	(0.000921)	(-4.25)	(0.0138)
Head Education	-0.062	0.00143	-0.346*	0.0191
	(-0.21)	(0.00208)	(-2.27)	(0.0171)
Dependency ratio	0.101	0.000914	0.453***	0.00516
	(0.53)	(0.00130)	(3.63)	(0.0147)
Expected rangeland above normal	-0.009	0.00349	0.058	0.0511
	(-0.18)	(0.00513)	(1.65)	(0.0602)
Expected rangeland below normal	0.027	0.00370	-0.041	0.0539
	(0.41)	(0.00458)	(-0.90)	(0.0414)
Age of household head	-4.898	0.000004	2.350	0.000782
	(-1.68)	0.0000574	(1.21)	(0.000915)
Asset Index	-0.100	0.000385	-0.525***	0.00979
	(-0.75)	(0.00119)	(-5.75)	(0.0188)
ln Income	-0.971***	-0.000181	-0.755***	-0.00405
	(-6.16)	(0.00194)	(-8.92)	(0.0363)
ln Herd Size	-0.822***	-0.00504	-0.871***	-0.0820**
	(-4.16)	(0.00554)	(-8.62)	(0.0341)
ln Savings	-0.362	0.000217	-0.963***	0.00770
	(-0.91)	(0.000421)	(-3.89)	(0.00594)
Observations	514	512	514	512

T-statistics and standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

APPENDIX C: Description of Qualitative Study

Introduction

Mixed methodological and interdisciplinary approaches have been common in many disciplines, including development economics, since the 1980s. The 2001 "Q-squared" workshop and associated compilation of works (Kanbur 2002) highlighted the use of multiple research methodologies as a corollary to the broader interest in interdisciplinary social science research. Within development economics, qualitative methodologies are increasingly used to tackle questions of identification of the poor and causal explanations of poverty (see Shaffer 2013 for review). Qualitative approaches have contributed to these analyses in a variety of ways, such as determining locally meaningful definitions and weights for dimensions of poverty, which are then incorporated into formal modeling, as well as enriching understanding of the overall causal framework underlying poverty dynamics.[xvi] Few, if any, mixed methods studies in development economics explicitly describe the qualitative methods used to the extent that is demanded in quantitative studies. Quantitative methodological procedures are made explicit, but qualitative are not, which undermines the credibility of inferences drawn using qualitative data (see Constas 1992).

Methodologically, this study aims to take the Q-squared work a step further by making explicit the purposes of qualitative approaches for the questions of interest and the procedures used. The credibility of any empirical finding hinges upon adherence to standards of validity and reliability in data collection tools, and the nature of the inference one intends to make from data is associated with a necessary level of rigor in these areas (Shadish, Cook, and Campbell 2002). With this in mind, this study applies lessons learned from Q-squared in order to understand the determinants of demand for Index-Based Livestock Insurance (IBLI) that vary by gender in the Borana Zone of southern Ethiopia. Within this, some sub-questions lend themselves easily to quantitative approaches, while others benefit from a complementary qualitative approach. Questions focused on the magnitude and direction of relationships, and the relative influence of variables on IBLI purchase behaviors are well served by quantitative approaches. Questions focused on individual perceptions, reasoning processes, and context-dependent

explanations associated with the decision to purchase IBLI are well served by qualitative approaches. From a modeling perspective, qualitative methods can improve modeling precision by exploring the structure of measurement error in existing quantitative data and identify omitted variables. Key quantitative research questions and their qualitative extensions (italics) include:

1. What is the relationship between gender and the IBLI purchase decision?
    a. *How and why does household decision-making differ by gender and marital status of household head?*
2. Does the relationship between risk aversion and demand for IBLI vary by gender? If so, how?
    a. What are men and women's perceptions of risks associated with IBLI purchase?
3. What is the relationship between informal insurance and demand for IBLI?
    a. *What insurance strategies, if any, are represented by informal transfers and network group participation?*
    b. *Outside of transfers and network group participation, what forms does informal insurance take in Borana?*
4. Does the relationship between informal insurance and IBLI vary between men and women?
    a. *Do women experience informal insurance differently than men in terms of access and coverage?*
    b. *Among women, how and why do/don't informal insurance experiences and coverage differ?*
5. What is the relationship between IBLI information channels and IBLI uptake by gender?
    a. *What are women and men's preferred marketing channels and what reasons are given for such preferences?*

For each of these five sets of questions, qualitative approaches bring more detailed descriptive content to existing quantitative data, which extends our understanding in three specific ways. The first of

these, is aiding in model specification. Qualitative data will provide an opportunity to validate assumptions made during construction of key variables in the econometric model so that they more accurately reflect determinants of IBLI demand. This is particularly relevant given the unique and rapidly changing cultural and economic practices of southern Ethiopian pastoralists in the 21st century.

Second, qualitative data may reveal heterogeneity within categories that appear homogeneous in quantitative data. Difficult-to-capture drivers of behavior such as social status may vary dramatically among the seemingly homogeneous categories such as "women," or "men," and qualitative exploration of these categories may explain contradictory or inconclusive findings. Finally, insights gained from qualitative data will be used to strengthen the interpretation of econometric findings in order to explain outliers, inconsistent findings and provide descriptive support. The ways which each of these purposes supports deeper understanding of the above research questions are described in detail in the following section.

Gender and the IBLI purchase decision

This line of inquiry is designed to investigate intra-household decision-making related to IBLI purchase. The quantitative strategy uses household level data with the gender of the household head as a proxy for the gender of IBLI purchaser. This approach may limit understanding of intra-household dynamics that affect the decision to purchase IBLI. The quantitative strategy accounts for some degree of bargaining in two-adult households, but is unable to shed light on decision-making in single-adult households. Single adult households in the sample are all female-headed, but autonomy and social status will affect the decision-making power of these individuals and likely varies by marital status (McPeak et al. 2011). Qualitative interviews will focus on who in the household initiated decision-making related to IBLI, the involvement and influence of different household members, and how this decision-making process compares to other household decisions. These data will be used to unpack heterogeneity of decision-making processes, with particular emphasis on single-adult households. Qualitative data on two-adult households will aid in the interpretation of bargaining-related quantitative findings.

Risk aversion, gender and IBLI demand

Perceptions of the IBLI product are clearly linked to the decision to purchase. Theory suggests that a risk averse individual will have a higher willingness-to-pay for insurance, however, the relationship between risk aversion and index-based insurance products does not convincingly follow this pattern (Giné et al. 2008, Cole et al. 2012). If purchasing the insurance product is perceived as risky in itself, then the individual's ambiguity aversion becomes an important factor if he or she prefers the known risk of, say, drought to the relatively unknown risk of drought insurance. Ambiguity aversion has been cited as a reason for poor uptake of index-based products and has been incorporated into some studies of demand (Clarke and Dercon 2009, Clarke 2011). Elabed et al. (2013) link ambiguity aversion to compound risk aversion in an experimental setting involving index insurance decisions, finding that compound risk aversion may play a role in limited demand for index insurance products. The quantitative strategy for understanding risk aversion and IBLI demand does not allow for ambiguity aversion as a determinant of demand. Those who are risk-averse but opt not to purchase IBLI may be doing so because they perceive IBLI purchase to be an unknown risk relative to drought. In a review of four field studies of index insurance marketing, Patt et al. (2009) identify three sources of perceived risk by consumers as (a) lack of trust in the implementers of the insurance product, (b) lack of trust in the index and (c) lack of trust in one's own understanding of the product and associated ability to make the best decision. Qualitative interviews will focus on trust in these aspects of IBLI and, using Patt's framework, the data will allow for better understanding of the potential role of ambiguity aversion. Of particular interest is whether there is a difference in trust in the IBLI product between men and women, which will contribute to interpretation of econometric results relating to risk aversion.

Informal insurance and IBLI demand

The relationship between informal insurance strategies and formal insurance products is key to understanding demand for IBLI. The quantitative strategy for understanding this relationship uses data on

cash and in-kind transfers and network group membership to represent access to and coverage by informal insurance. Limitations of the use of observed transfers or network groups are multifold. First, transfers and network groups are institutions that have the potential to provide insurance, but the extent to which they do so is unknown and therefore these may be poor measures of informal insurance. Second, they do not represent the complete set of transfers or network activities available to the respondent; they represent only those the respondent chose to activate in the reporting period. Finally, informal insurance behaviors are driven by unobserved characteristics that are likely to simultaneously influence IBLI demand. These challenges are very difficult to overcome analytically using qualitative or quantitative methods alone. Mixed methods using the best techniques from each side may be especially useful. Interviews will attempt to understand the extent to which reported transfers and groups represent insurance by eliciting detailed information on the circumstances surrounding actual transfers received and given as well as network group participation reported in the household survey. Of particular interest are the circumstances and expectations surrounding the transfer and, for transfers given, the consequences of not agreeing to give the transfer. For transfers received, we will attempt to elicit information on hypothetical alternative sources of transfers and/or recourse available to the recipient had the giver refused to give. Qualitative data will serve to validate existing survey data by uncovering heterogeneity in the functions of transfers and group membership. This may inform the specification or interpretation of the econometric model. Qualitative data will also provide description of other informal insurance strategies outside of transfers and network groups that may not have been captured in the survey data.

Informal insurance, gender and IBLI demand

Empirical evidence supports the hypothesis that there exist notable differences in access to and coverage by informal insurance along dimensions of wealth and social-connectedness (Santos and Barrett 2011, Vanderpuye-Orgle and Barrett 2009). Gender differences in wealth and social-connectedness are visible in existing IBLI household data from the study region, suggesting the existence of gender differences in informal insurance access and coverage. Within female-headed households, one sees

variation in wealth and social connectedness by marital status, suggesting further heterogeneity within the female informal insurance experience. Interviews will focus on perceptions and perceived drivers of relative access to and coverage by informal insurance by gender and marital status. Qualitative data will aid in understanding heterogeneity among female-headed households and support interpretation of findings related to the interaction of gender and informal insurance on IBLI demand.

Gender and IBLI information channels

Index insurance products are often unfamiliar to their targeted consumers and, given the low levels of education in Borana, education about the product is a major component of product marketing. Gender sensitivity in marketing and education is relevant where gender roles potentially result in different access to information channels and intensities. The extent to which this is the case in the study population is unknown. Quantitative data used for understanding how information channels interact with gender are limited to the nature of marketing channels, but do not capture the intensity of exposure to information from each channel or the individual's relative difficulty or ease of accessing each channel. Interviews will reference reported sources of information about IBLI and elicit individual's experiences and preferences relating information channels. These data will contribute to basic understanding of information channel preferences by gender, as well as elicit richer description of households' information experience in terms of access and intensity. Information channel preferences will provide the basis for econometric specification of the information channel variable used in testing gender differences.

Qualitative Methodological Procedures

Sampling

The qualitative sample will be a sub-sample of the survey households. We sampled for heterogeneity along pertinent characteristics of the full household survey sample as diagrammed in Figure 1 below. Heterogeneous sampling generates detailed descriptions of unique categories as well as

crosscutting patterns that derive their significance from having emerged out of heterogeneity (Patton 2002). Categories of interest in this study are IBLI purchase, gender of household head and marital status. IBLI purchase and gender of household head are the top characteristics of interest, therefore the full survey sample is divided into subgroups of those who purchased and those who did not and further subdivided by the gender of the household head. Adding marital status as a third sampling dimension allows us to better understand commonalities and differences among women based on the rationale that female-headed households may differ markedly depending on whether the female head is married, widowed or divorced. There is no variation in marital status of male-headed households, as men appear to remarry quickly after losing a spouse. Finally, given that wealth is associated, both empirically and in the survey data, with gender, informal insurance and marital status, we consider wealth when selecting my sample.

The sampling scheme is depicted in Figure 1C. Distributions are stylized representations of relative distributions from the R2 data.[xvii] we sample eight individuals at the median wealth level in each cell, as illustrated by the solid stars.[xviii] As a measure of wealth, we used the household's herd size because of the centrality of livestock to Boran livelihoods. Given its importance, extra care and diligence is taken by enumerators when collecting herd size data and therefore they are hopefully measured with less error. Because wealth is a likely driver of many phenomena of interest in this study and wealth levels are significantly different in existing survey data between male and female household heads of different marital statuses, we have chosen to interview six additional women with wealth levels that correspond to the median wealth of the male interviewee of the same purchase category, as depicted by the blue lines and six transparent stars. Comparison of responses between men and women of the same wealth level may be suggestive of the extent to which wealth is a driver of the phenomena of interest.

Time and resources necessarily limit the sample size. The choice to oversample women is justified by existing evidence in the survey data that there is notable heterogeneity in female-headed households within the study population. Better understanding how this heterogeneity influences insurance access by women is a necessary step toward understanding whether IBLI is a gender-neutral intervention.

Although generalization is obviously not possible with such a limited sample size, the qualitative findings derived from this study will provide an inductively grounded set of propositions that can direct future analysis in the present study and help formulate questions for future studies.

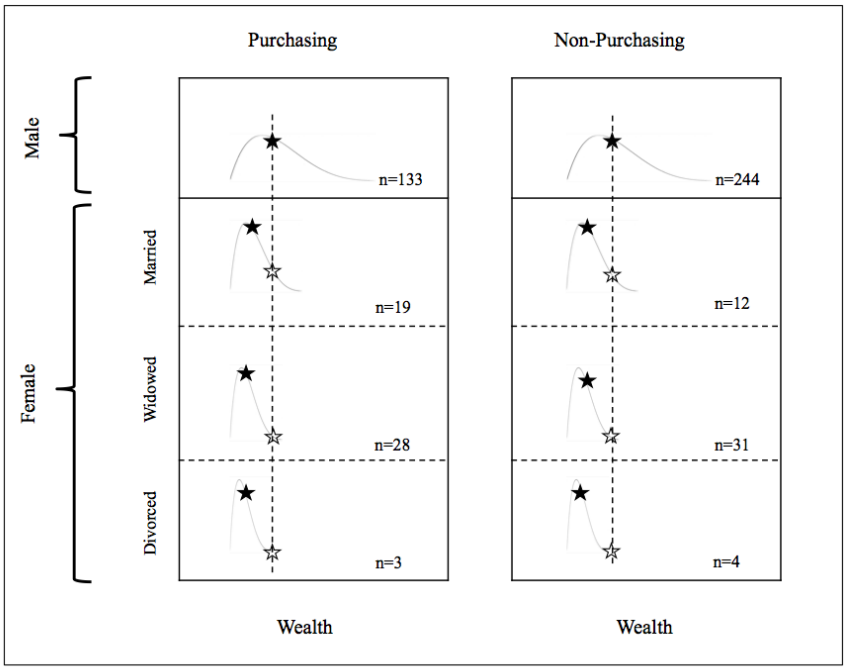

Figure 1C: Original Qualitative Sampling Design

The sampling scheme was confounded by measurement error in the IBLI purchase and marital status variables. After attempting to correct for and replace households with mis-measured key characteristics, the structure of the sample changed from what is depicted in Figure 1C to that depicted in Figure 2C. Additional time for interviews also allowed for two extra males to be sampled that had been excluded previously due to anticipated time constraints.

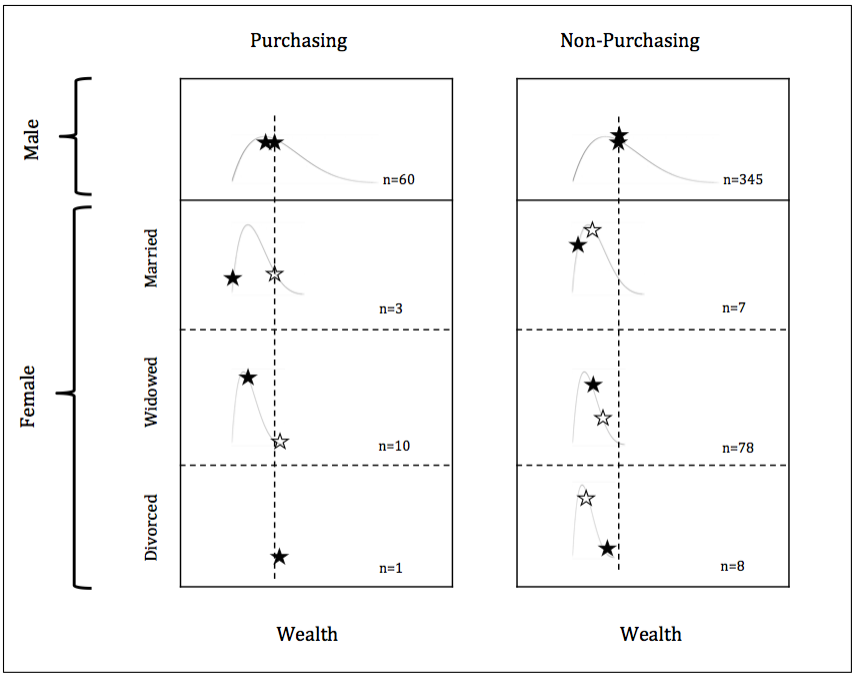

Figure 2C: Actual Qualitative Sample

Interview Procedure

The final interview guide is included below. There are several key features of the interview guide. First, a standardized set of probes inspired by Patton (2002) was developed for eliciting complete responses. Four types of probes were intended encourage the elaboration, clarification, justification and illustration of responses. These probes were intended to be used consistently throughout the interview to minimize bias induced by spontaneous phrasing of probes, however these efforts were thwarted by challenges involving interpretation in the actual implementation and standardized probes were rarely used. Other questions were designed to be initially open-ended, with pre-defined prompts associated with key concepts from previous empirical work. Prompts were used as needed when open-ended questions and probes failed to touch upon key topics. In order to connect the quantitative and qualitative data in a way that allows for meaningful inference, some interview questions were structured around quantitative data points for the household in question. For example, we used respondents' R3 data on transfers given, transfers received and network group participation to structure the informal insurance section of the interview around discussions of specific transfers and groups the household was involved in. Discussions

of information channels drew on data reported by the household on the sources of IBLI information that they reported in R3. This guide was refined in the field through pre-testing (out-of-sample) prior to the interviews.

Interviews were conducted over three weeks following collection of the R3 household survey data. Interviews were held in or near the respondents' homes, with the exception of three interviews that were held in a neighboring village due to inaccessibility of the respondents' home villages. Interviews were conducted using an experienced interpreter who underwent three days of training specific to the interview guide. Training included discussion of key terms and their interpretations in Oromiffaa, careful translation of questions, probes and prompts, and field-testing of interview guide. Oral consent was obtained using the IRB-approved consent script included below. The interview took between 2 and 4 hours and the respondents were compensated with ETB 100 for their time.

Analysis procedure

Transcription and analysis of interview data took place in the weeks following the interviews. Analysis took both deductive and inductive forms based on previous empirical findings, theory, and observed limits of theory. A pre-determined analytical framework for each theme (noted in the second column of tables in interview guide) was developed based on previous empirical findings. Where there was little or no previous work around which to structure a framework, a more inductive strategy was taken with the objective of exploring the range of responses.

Deductive analysis began with a coding process associated with each pre-determined analytical bins. We also analyzed residual responses that did not conform to the analytical bins in a more inductive manner. The second stage of analysis was to involve comparisons of response dominance between men and women (Sections A-E of interview guide), purchasers and non-purchasers (Section B), lower and higher wealth households (Sections C and D) and among women of different marital statuses (Section D). Dominant responses are defined using a frequency threshold or those with low frequency but a direct relationship to theory or previous empirical findings. We define "strong dominance" as a response

frequency of over 66% in any given category, weak dominance as less than 33% in a given category and moderate dominance as the interval in between. Some weak responses were meaningful and worthy of analytical attention, despite their infrequency, due to their alignment with theory and/or previous empirical findings.

Inductive analysis involved looking for response dominance and relational patterns within responses where there was weak or no empirical precedent for analysis and/or where individual experiences diverge from the analytical bins. Divergences and commonalities across responses were recorded, as well as comparisons between key groups discussed above.

References:

Adato, M., Lund, F., & Mhlongo, P. (2007). Methodological Innovations in Research on the Dynamics of Poverty: A Longitudinal Study in KwaZulu-Natal, South Africa. *World Development*, *35*(2), 247–263.

Bhattamishra, R., & Barrett, C. B. (2010). Community-Based Risk Management Arrangements: A Review. *World Development*, *38*(7), 923–932.

Clarke, D. (2011). Insurance design for developing countries. *DPhil in Economics, University of Oxford*.

Clarke, D., & Dercon, S. (2009). Insurance, credit and safety nets for the poor in a world of risk. *United Nations, Department of Economics and Social Affairs, Working Paper*, *81*.

Cole, S., Bastian, G. G., Vyas, S., Wendel, C., & Stein, D. (2012). The effectiveness of index-based micro-insurance in helping smallholders manage weather-related risks.

Constas, M. A. (1992). Qualitative Analysis as a Public Event: The Documentation of Category Development Procedures. *American Educational Research Journal*, *29*(2), 253–266.

Coppock, D. L. (1994). *The Borana Plateau of Southern Ethiopia: Synthesis of Pastoral Research, Development and Change, 1980-91*. Addis Ababa: ILRI.

Davis, H. L. (1976). Decision making within the household. *Journal of Consumer Research*, 241–260.

Elabed, G., & Carter, M. R. (2013). Compound-risk Aversion and the Demand for Microinsurance. Working Paper.

Gine, X., Townsend, R., & Vickery, J. (2008). Patterns of Rainfall Insurance Participation in Rural India. *The World Bank Economic Review*, *22*(3), 539–566.

Kanbur, S. M. R. (2003). *Q-squared, Combining Qualitative and Quantitative Methods in Poverty Appraisal*. (R. Kanbur). Delhi: Permanent Black.

Krishna, A. (n.d.). Subjective Assessments, Participatory Methods and Poverty Dynamics: The Stages of Progress Method. In T. Addison, D. Hulme, & R. Kanbur, *Poverty Dynamics: Interdisciplinary Perspectives*. Oxford: Oxford University Press.

McPeak, J. (2006). Confronting the risk of asset loss: What role do livestock transfers in northern Kenya play? *Journal of Development Economics*, *81*(2), 415–437.

McPeak, J., Little, P. D., & Doss, C. R. (n.d.). *Risk and Social Change in an African Rural Economy: Livelihoods in pastoralist communities* (Vol. 1). New York: Routledge.

Mitchell, V.-W., & Boustani, P. (1994). A Preliminary Investigation into Pre- and Post-Purchase Risk Perception and Reduction. *European Journal of Marketing*, *28*(1), 56–71.

Morduch, J. (1999). Between the State and the Market: Can Informal Insurance Patch the Safety Net? *The World Bank Research Observer*, *14*(2), 187–207.

Parker, B., & Kozel, V. (2007). Understanding Poverty and Vulnerability in India's Uttar Pradesh and Bihar: A Q-squared Approach. *World Development*, *35*(2), 296–311.

Patt, A., Peterson, N., Carter, M., Velez, M., Hess, U., & Suarez, P. (2009). Making index insurance attractive to farmers. *Mitigation and Adaptation Strategies for Global Change*, *14*(8), 737–753.

Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods*. SAGE Publications.

Santos, P., & Barrett, C. (2006). Informal insurance in the presence of poverty traps: Evidence from southern Ethiopia. *Available at SSRN 998541*.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and Quasi-experimental Designs for Generalized Causal Inference*. Boston: Houghton Mifflin Company.
Shaffer, P. (2013). Ten Years of "Q-Squared": Implications for Understanding and Explaining Poverty. *World Development*, *45*(C), 269–285.

Sharp, K. (2003). Measuring destitution: integrating qualitative and quantitative approaches in the analysis of survey data. *IDS Working Paper #217.* Institude for Development Studies.

Vanderpuye Orgle, J., & Barrett, C. B. (2009). Risk Management and Social Visibility in Ghana*. *African Development Review*, *21*(1), 5–35.

APPENDIX D: Additional Results

Table D1: IBLI Purchase Decision--Reported (AME)

	(1)	(2)	(3)
Female headed household	-0.115	0.002	0.251
	(0.178)	(0.217)	(0.353)
Female Head X HS at marriage			-0.025
			(0.144)
HS at marriage			0.027
			(0.032)
Female Head X Home info		0.001	0.002
		(0.001)	(0.002)
Home-centered information		-0.001	-0.001
		(0.001)	(0.001)
Female Head X Transfers		0.003	-0.022
		(0.015)	(0.032)
ln Transfers		-0.007	-0.004
		(0.008)	(0.008)
Female Head X Moderate risk aversion		0.033	0.010
		(0.050)	(0.099)
Moderate risk aversion		-0.021	-0.025
		(0.024)	(0.024)
Female Head X High risk aversion		-0.127	-0.079
		(0.080)	(0.254)
High risk aversion		-0.513	-0.517
		(1.147)	(1.171)
ln Effective price per TLU	-0.023	-0.022*	-0.019
	(0.015)	(0.013)	(0.014)
Lagged IBLI purchase		-0.100***	-0.110***
		(0.026)	(0.030)
Assigned coupon	0.123***	0.118***	0.128***
	(0.031)	(0.030)	(0.033)
Household Average Characteristic	HAC1	HAC2	HAC2
Observations	1,824	1,824	1,510
LR Chi2	117.49	585.92	487.83
Prob > Chi2	0.000	0.000	0.000

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The following coefficients are non-significant and not reported: IBLI knowledge, education, previous period losses dependency ratio, expected rangeland conditions, age, age-squared, non-livestock assets, (ln)income, savings, proportion of income from livestock and (ln)herd. HAC2 contains head age and age-squared, non-livestock assets, income, proportion of income from livestock, cash savings, previous period purchase, effective price, IBLI knowledge and all HAC1.

Table D2: Level of IBLI Purchase--Reported

	(1)	(2)	(3)
Female headed household	0.198	0.257	0.221
	(0.526)	(0.744)	(1.219)
Female Head X HS at marriage			1.107**
			(0.457)
HS at marriage			-0.071
			(0.093)
Female Head X Home info		0.0001	0.002
		(0.004)	(0.008)
Home-centered information		-0.0002	0.002
		(0.002)	(0.003)
Female Head X Transfers		0.020	0.008
		(0.043)	(0.094)
ln Transfers		-0.011	-0.014
		(0.024)	(0.027)
Female Head X Moderate risk aversion		-0.197	-0.293
		(0.149)	(0.285)
Moderate risk aversion		0.030	0.028
		(0.072)	(0.076)
Female Head X High risk aversion		0.025	-1.764**
		(0.253)	(0.842)
High risk aversion		-0.443	0.443
		(2.953)	(3.147)
Financial literacy		0.029	0.057*
		(0.026)	(0.031)
ln Effective price per TLU	-0.138***	-0.133***	-0.087**
	(0.047)	(0.037)	(0.039)
ln Previous period losses (TLU)	0.101*	-0.063	0.022
	(0.060)	(0.065)	(0.075)
Savings > 5 TLU		-0.360***	-0.371***
		(0.129)	(0.140)
lambda	0.441	0.285	-0.226
	(0.318)	(0.203)	(0.204)
Constant	2.925***	2.797***	3.388***
	(0.324)	(0.765)	(0.768)
Household Average Controls	HAC1	HAC2	HAC2
Observations	1,824	1,824	1,510
Chi2	187.8	354.4	250.4
Prob > Chi2	0.000	0.000	0.000

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The following coefficients are non-significant and not reported: IBLI knowledge, education, previous period purchase, dependency ratio, expected rangeland conditions, age, age-squared, non-livestock assets, (ln)income, proportion of income from livestock and (ln)herd. HAC2 contains head age and age-squared, non-livestock assets, income, proportion of income from livestock, cash savings, previous period purchase, effective price, IBLI knowledge and all HAC1.

Table D3: IBLI Purchase Decision--OIC Records=Reported Purchase (AME)

	(1)	(2)	(3)
Female headed household	-0.066	0.190	0.307
	(0.191)	(0.119)	(0.193)
Female Head X HS at marriage			-0.072
			(0.065)
HS at marriage			0.020
			(0.014)
Female Head X Home info		-0.00005	0.0004
		(0.0005)	(0.001)
Home-centered information		0.0001	0.0003
		(0.0003)	(0.0003)
Female Head X Transfers		-0.001	-0.024
		(0.006)	(0.018)
ln Transfers		-0.001	0.0002
		(0.004)	(0.004)
Female Head X Moderate risk aversion		-0.012	-0.054
		(0.021)	(0.041)
Moderate risk aversion		0.007	0.008
		(0.011)	(0.011)
Female Head X High risk aversion		-0.066*	-0.062
		(0.038)	(0.120)
High risk aversion		-0.109	-0.175
		(0.474)	(0.470)
ln Effective price per TLU	-0.108***	-0.050***	-0.051***
	(0.018)	(0.011)	(0.013)
Lagged IBLI purchase		-0.130***	-0.122***
		(0.023)	(0.025)
Dependency ratio	0.002	-0.013	-0.035**
	(0.009)	(0.012)	(0.017)
ln Previous period losses (TLU)	-0.022	-0.023**	-0.028**
	(0.017)	(0.010)	(0.011)
Assigned coupon	0.083***	0.054***	0.047***
	(0.032)	(0.017)	(0.018)
Age of household head		-0.046***	-0.041**
		(0.015)	(0.018)
Age squared		0.0003**	0.0003**
		(0.0001)	(0.0001)
Proportion of income from livestock		-0.0005**	-0.0004*
		(0.0002)	(0.0002)
Savings > 5 TLU		0.040*	0.042*
		(0.022)	(0.023)
Household Average Controls	HAC1	HAC2	HAC2
Observations	1,581	1,581	1,305
LR Chi2	217.84	739.32	638.63
Prob > Chi2	0.000	0.000	0.000

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The following coefficients are non-significant and not reported: IBLI knowledge, financial literacy, education, dependency ratio, expected rangeland conditions, non-livestock assets, income and (ln)herd. HAC1 includes dependency ratio, expected rangeland conditions and effective price. HAC2 contains head age and age-squared, non-livestock assets, income, proportion of income from livestock, cash savings, previous period purchase, effective price, IBLI knowledge and all HAC1.

Table D4: Level of IBLI Purchase--OIC Records = Reported Purchase

	(1)	(2)	(3)
Female headed household	0.796	7.893***	10.021***
	(0.644)	(2.108)	(2.747)
Female Head X HS at marriage			0.776*
			(0.425)
HS at marriage			-0.045
			(0.073)
Female Head X Home info		-0.003	-0.003
		(0.003)	(0.008)
Home-centered information		0.001	0.002
		(0.002)	(0.002)
Female Head X Transfers		-0.047	-0.097
		(0.040)	(0.094)
ln Transfers		0.023	0.016
		(0.023)	(0.025)
Female Head X Moderate risk aversion		-0.169	-0.142
		(0.141)	(0.268)
Moderate risk aversion		0.006	-0.021
		(0.066)	(0.068)
Female Head X High risk aversion		0.235	-1.095
		(0.238)	(0.892)
High risk aversion		0.565	1.964
		(2.889)	(2.934)
IBLI knowledge		0.064**	0.075**
		(0.027)	(0.030)
Head Education		-0.053***	-0.060***
		(0.019)	(0.019)
ln Effective price per TLU	-0.486***	-0.338***	-0.343***
	(0.081)	(0.038)	(0.038)
Age of household head		-0.438***	-0.477***
		(0.138)	(0.147)
Age squared		0.003***	0.003***
		(0.001)	(0.001)
lambda	0.480**	-0.046	-0.069
	(0.223)	(0.088)	(0.082)
Constant	2.905***	3.173***	3.468***
	(0.262)	(0.596)	(0.644)
Household Average Characteristics	HAC1	HAC2	HAC2
Observations	1,581	1,581	1,305
Chi2	245.2	656.6	620.9
Prob > Chi2	0.000	0.000	0.000

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The following coefficients are non-significant and not reported: Savings, non-livestock assets, income, herd size, (ln)income, proportion of income from livestock, financial literacy, expected rangeland conditions, previous period purchase and previous perid losses. HAC1 includes dependency ratio, expected rangeland conditions and effective price. HAC2 contains head age and age-squared, non-livestock assets, income, proportion of income from livestock, cash savings, previous period purchase, effective price, IBLI knowledge and all HAC1.

Table D5: Intrahousehold Bargaining in Two-Decision-Maker Households

	(1) Sugar	(2) Tobacco	(3) Drinks	(4) Cooking fuel	(5) School	(6) Soap
Female: (ln) Lactating herd	1,792	187.2**	252.9	303.3*	-31.37	-140.3*
	(1,471)	(76.46)	(165.8)	(131.7)	(36.88)	(59.82)
Male: (ln) Non-lactating herd	-902.8	-180.6	-177.6	-320.0	3.459	9.538
	(1,378)	(131.1)	(95.82)	(200.0)	(26.33)	(58.65)
Controls	Y	Y	Y	Y	Y	Y
Household FE	Y	Y	Y	Y	Y	Y
Observations	1,024	1,024	1,024	1,024	1,024	1,024
R-squared	0.010	0.017	0.020	0.094	0.014	0.023
F-statistic	8.830	5.610	3.104	4.313	0.527	2.343
Prob (Female=Male)	0.0208**	0.0497**	0.121	0.0764*	0.491	0.170
rho	0.496	0.457	0.548	0.883	0.406	0.333
Horri Siiqqee (% at marriage)	-546.9	-211.2	-101.2	6.773	-42.31**	-67.96
	(1,564)	(265.1)	(135.2)	(222.2)	(14.22)	(41.95)
Controls	Y	Y	Y	Y	Y	Y
Household FE	N	N	N	N	N	N
Observations	996	996	996	996	996	996
R-squared	0.009	0.011	0.063	0.035	0.090	0.068
(ln) Female cash income	-164.6	-11.64	1.694	-36.51	-0.829	16.05**
	(181.5)	(10.63)	(15.04)	(25.71)	(5.908)	(5.191)
(ln) Male cash income	273.9	29.77	2.317	-39.65	-1.477	32.48**
	(197.4)	(26.59)	(48.94)	(40.08)	(10.07)	(13.51)
Controls	Y	Y	Y	Y	Y	Y
Household FE	Y	Y	Y	Y	Y	Y
Observations	955	955	955	955	955	955
R-squared	0.010	0.011	0.016	0.093	0.006	0.026
F-statistic	1.637	2.458	0.000226	0.00711	0.00622	1.370
Prob (Female=Male)	0.241	0.161	0.988	0.935	0.939	0.280
rho	0.429	0.420	0.448	0.897	0.450	0.458

Controls include household assets, savings, transfers received and household demographic characteristics. Robust standard errors clustered at woreda level. Sub-sample excludes households with 1 or >2 decision-makers. *** p<0.01, ** p<0.05, * p<0.1

[xvi] See Krishna's (2009) Stages of Progress methodology, Parker and Kozel (2007), Sharp (2007), Adato et al. (2007) for examples.

[xvii] The number of individuals (n) in each cell of Figure 1C was determined using the R2 survey data. In Figure 2C, n has been updated using R3 survey data.
[xviii] Median-based sampling is chosen due to the positively skewed nature of wealth distributions and outliers in the right tails.