The Impact of Microinsurance on Consumption Smoothing and Asset Protection: Evidence from a Drought in Kenya

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Abstract:

When natural disasters strike in developing countries, households are often forced to choose between preserving assets or consumption: either can result in permanent consequences. In this paper we ask: can insurance transfer risk in a way that reduces the need for households to rely on costly coping strategies that undermine their future productivity? Since 2010, pastoralists in northern Kenya have had access to a novel index-based drought insurance product. We analyze the impact of a drought-induced insurance payout on consumption smoothing and asset protection in this setting. Our results show that insured households are on average 36 percentage points less likely to anticipate drawing down assets, and 25 percentage points less likely to anticipate reducing meals upon receipt of a payout. Empirical evidence of a poverty trap in this setting suggests that these average impacts may mask a heterogeneous behavioral response and subsequent heterogeneous impacts of insurance. For this reason we use Hansen's (2000) threshold estimator to estimate a critical asset threshold around which optimal coping strategies bifurcate. Using this approach we find that that households holding assets above a critical asset threshold, who are also most likely to sell assets, are 64 percentage points less likely to anticipate doing so when an insurance payout is available. Households holding assets below the estimated threshold, who are likely to destabilize consumption, are 43 percentage points less likely to anticipate doing so with insurance. Together, these results suggest that insurance can help households to protect assets during crises, without having the deleterious effect on human capital investments.

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Whenever extreme drought strikes northern Kenya, the effects can be devastating. Livestock, the primary asset and source of livelihood, weaken and often die. Distressed sales of livestock flood the market, causing downward pressure on livestock prices. The combination of livestock loss and destocking herds debilitates the household's main productive resource, making recovery after the drought all the more challenging. In an effort to maintain assets, households may instead choose to cut back on meals. Yet by reducing consumption, households undercut critical investments in human capital, inhibiting both current and future productivity. In these ways a single negative shock can lead to chronic poverty by restricting the ability of a multi-generational family to generate current and future income. In this paper we assess whether insurance offers an effective alternative to these costly coping strategies which make recovery so difficult.

Insurance has been widely heralded in the past decade as a market-based risk transfer mechanism that has the potential to act as a safety net, preventing against catastrophic collapse. Although development of insurance pilot projects have been widespread, little is known about their impact. In this paper we ask: Can microinsurance designed for poor households transfer risk in such a way that it reduces the need for households to rely on costly coping strategies that undermine future productivity? In particular, are insured households less likely to sell livestock or reduce consumption?

A growing evidence base suggests that microinsurance designed for poor households can influence households' ex ante risk management decisions. This analysis offers one of the first empirical assessments of the impact of a market-based index insurance contract on a household's ability to cope with shocks ex post. We report the impact results from the index-based livestock insurance (IBLI) pilot in Marsabit district of northern Kenya. Since 2010, pastoralists in northern Kenya have had the opportunity to purchase a novel index-based insurance contract to protect against livestock mortality losses due to drought. A harsh drought swept the Horn of Africa in 2011 activating the first IBLI payout. We use households' reported intentions at the time of the payout to empirically study the impact of the index-based livestock insurance on pastoralist households' consumption decisions and their ability to protect key productive assets, namely livestock.

Our results reveal that, relative to uninsured households, insured households expect to radically reduce their dependence on costly coping strategies which impair their future productivity. 1) Insured households are on average 36 percentage points less likely to anticipate selling livestock in the wake of the 2011 drought (overall a 50% reduction), improving their ability to generate income after drought. 2) Insured households are on average 25 percentage points less likely to reduce meals than their uninsured counterpart (an overall reduction of about one third). This behavioral change implies a reduction in the number of undernourished and malnourished individuals, including women and children, in this food insecure region.

This paper also makes a contribution to the literature of poverty traps. This literature suggests that in certain environments, there exists a critical asset threshold at which we observe a bifurcation in optimal behavior. Households with asset stocks safely above the threshold will be more willing to forfeit assets in order to smooth consumption when an adverse shock hits. Alternatively, households with small asset stocks will optimally choose to destabilize consumption in order to smooth assets. Empirical evidence of a poverty trap in our research setting suggests that simply estimating the average impact of insurance may mask a heterogeneous behavioral response and subsequent heterogeneous insurance impact. For this reason, we use Hansen's (2000) threshold estimation method, and provide evidence that a behavioral threshold does indeed exist in this setting: consumption smoothing is more common above an estimated threshold, and asset smoothing is more common below an estimated threshold. This finding implies that simply estimating the average effect of insurance may lead to biased estimates. The results of this threshold-based approach suggest: 1) Households holding assets above the estimated threshold, who are most likely to sell assets, are 64 percentage points less likely to anticipate doing so when an insurance payout is available. 2) Households holding assets below the estimated critical threshold, who are prone to destabilizing consumption, are 43 percentage points less likely to anticipate doing so with insurance. Together, these results suggest that insurance can help households to protect assets during crises, without having a deleterious effect on human capital investments.

The rest of the paper is organized as follows: We begin with a discussion of the relevant literature. Section 1 reviews some of the related literature on risk in developing countries and its permanent consequences. Section 2 then provides an overview of the literature studying how insurance might help households to cope with uninsured risk and vulnerability, particularly in developing countries. In Section 3, we provide background information on the research setting, and discuss the available data. Our estimation strategy is outlined in Section 4. We use an instrumental variables approach to control for endogeneity in the decision to insure, combined with Hansen's (2000) threshold estimator to produce expected heterogeneous impacts of livestock insurance payouts in northern Kenya. In Section 5, we present and discuss our main finding: that insurance, and specifically an insurance payout in the midst of a shock, dramatically reduces the need for a household to depend on costly coping strategies which undermine its future productivity. In Section 6 we take advantage of data regarding pre-payout drought coping strategies to analyze the impact of insurance on consumption and asset smoothing behaviors prior to receipt of an insurance payout. These findings are inconclusive, and reflect the idea that people may have some distrust or incomplete understanding about how insurance works. Section 7 concludes, and an appendix provides additional ex post impact results using alternative approaches.

1 Shocks and their Permanent Consequences

Uninsured risk and vulnerability can be an unavoidable part of daily life for households in developing countries. Not only can shocks give rise to temporary consequences, but there is growing evidence to suggest that shocks can result in permanent consequences. This finding has developed into a wide literature of poverty traps. A poverty trap has been defined as "any self-reinforcing mechanism which causes poverty to persist." (Azariadis and Stachurski, 2005). This literature has often focused on multiple equilibrium poverty traps, which are characterized by at least one equilibrium associated with a poor standard of living, and another associated with a high standard of living. The existence of multiple equilibria also implies the existence of a "threshold" or "tipping point" at the boundary between the two regions.

If a threshold exists, at which we observe a bifurcation of equilibrium outcomes, then a shock will result in permanent consequences whenever it propels a household across the threshold. Building on this concept, Carter and Barrett (2006) develop an asset-based approach in which they distinguish transitory poverty from chronic structural poverty by using a dynamic asset poverty line. In this framework, if assets fall below a critical threshold in any period, then households will find it difficult to accumulate assets; they become trapped in poverty.

The asset-based approach to understanding persistent poverty suggests an important behavioral response to critical thresholds. Zimmerman and Carter (2003) use stochastic dynamic programming techniques to show that households above the threshold will optimally choose to smooth consumption, whereas poorer households around the threshold will choose to smooth assets instead, because asset preservation is crucial to future consumption. Hoddinott (2006) provides evidence that in the wake of the 1994-1995 drought in Zimbabwe, richer households sold livestock in order to maintain consumption. In contrast, poor households with one or two oxen or cows were much less likely to sell livestock, massively destabilizing consumption instead. In Ethiopia, Carter et al. (2007) also find evidence of asset smoothing by the poor, as households coping with a drought attempted to hold onto their livestock at the cost of consumption. Carter and Lybbert (2012) find similar evidence in Burkina Faso. They empirically estimate an asset threshold, and show that households above the estimated dynamic asset threshold almost completely insulate their consumption from weather shocks by drawing down assets, whereas households below the threshold do not.

The dilemma, as Hoddinott (2006) points out, is that even though asset smoothing is an attempt to preserve assets, consumption is an input into the formation and maintenance of human capital. Hoddinott poignantly argues that, "The true distinction lies in households' choices regarding what type of capital - physical, financial, social or human (and which human) - that they should draw down given an income shock." While asset protection strategies are designed to avoid a poverty trap, they likely come at a very high cost of immediately reduced consumption, with potentially irreversible losses in child health and nutrition (Carter et al., 2007).

The outcomes of undernutrition and malnutrition are widely known. In children, these conditions can lead to muscle wastage, stunting, increased susceptibility to illness, lower motor and cognitive skills, slowed behavioral development, and increased morbidity and mortality (Ray, 1998; Martorell, 1999). Those that do survive suffer functional disadvantages as adults, including diminished intellectual performance, work capacity and strength. In women, undernourishment during childhood can be the cause of lower adult body mass, which means increased risk of delivery complications and lower birthweights for the next generation (Martorell, 1999). These outcomes set the stage for a pernicious intergenerational cycle of undernutrition and its destructive effects. Moreover, undernourishment during adulthood further diminishes muscular strength and increases susceptibility to disease. Such undernourishment in adults can also lead to a nutrition-based poverty trap if it decreases the capacity to do productive work (Dasgupta and Ray, 1986).

This dilemma points to a need for a productive safety net that protects vulnerable households from 1) losing productive assets, and 2) engaging in costly coping strategies which impair the human capital of current and future generations. Insurance is a market-based product which has the potential to act as a safety net (Barrett et al., 2007; Skees and Collier, 2008). It offers an alternative means of coping with negative shocks, allowing smoothing of consumption and nutrition, as well as avoidance of costly asset depletion (Dercon et al., 2008).

2 The Ex Ante and Ex Post Impacts of Microinsurance

A growing literature has been devoted to studying the benefits of insurance for poor households in low income countries. This type of insurance (targeted to poor households, and available at low cost) has become known as microinsurance. Barnett, Barrett, and Skees (2008), Dercon et al. (2008) and Cole et al. (2012) provide summaries of the literature. The literature highlights two primary avenues through which insurance might bring about positive impacts. These avenues reflect the fact that households make both *ex ante* risk management decisions and *ex post* risk coping decisions.

Section 1 suggests that poor households are limited in their ability to cope with risk *ex post*. Often such households are forced to choose between destabilizing critical consumption and depleting productive asset shocks, and either decision can result in permanent consequences. In the absence of insurance, there are several potential avenues for *ex ante* risk management, though all similarly involve tradeoffs. One option is to simply allocate resources toward activities with lower risk. However, these lower-risk activities generally produce a lower return. Another option is to build up precautionary savings, but such savings must come at the cost of (often critical) investment or consumption today. Households may also choose to reduce their risk exposure by diversifying crop choice, assets or activities, but such diversification is not always possible, and can only be beneficial if the risk involved is not perfectly correlated across the various activities (Dercon et al., 2008).

Insurance provides an alternative risk management tool that may reduce the use of these and other *ex ante* risk management strategies. By altering the ability of households to cope with risk *ex post*, insurance may change optimal behavior before a shock is actually observed. To demonstrate this effect, de Nicola (2011) estimates a dynamic stochastic model of weather insurance. The model predicts that insurance will increase the adoption of riskier but more productive seeds, and also stimulate decreased investment, as households shift towards higher levels of consumption. This may reflect the idea that investment is a form of precautionary savings in her model. Janzen, Carter, and Ikegami (2013) use similar methods to show that when you account for a critical asset threshold, around which optimal behavior and equilibrium outcomes bifurcate, increased investment occurs around the threshold as households assume greater risk in order to attain higher productivity and a higher equilibrium. The same model shows that households above the threshold follow de Nicola's prescription: decreased investment and increased consumption as households move away from holding assets as precautionary savings.

Cole et al. (2012) conduct a systematic review of the effectiveness of microinsurance, and specifically index-based insurance, in helping smallholders manage weather-related risks. Their review identifies a substantial evidence gap in the literature on the impact of index-based microinsurance. Several papers have attempted to bridge this gap empirically, but all papers known to the authors focus on the impact of insurance on household's *ex ante* risk management strategies. These papers all show that insurance encourages investment in higher risk activities with higher expected profits. Mobarak and Rosenzweig (2012) provide evidence that farmers in India with access to insurance shift into riskier, but higher-yielding rice production. Cai et al. (2012) find that insurance for sows significantly increases farmers' tendency to raise sows in southwestern China, where sow production is considered a risky production activity with potentially large returns. Karlan et al. (2012) show that farmers who purchase rainfall index insurance in Ghana increase agricultural investment. Bellemare et al. (2013) find that cooperatives with access to area-yield index insurance for cotton increased risky cotton production (and subsequent cotton inputs) in Mali. Cai (2012) demonstrates that tobacco insurance increases the land tobacco farmers devoted to risky tobacco production by 20% in China. This last finding implies reduced diversification among tobacco farmers. The same paper also finds that insurance causes households to decrease savings by more than 30%, suggesting that households were building up extra savings in order to better smooth consumption in the case of a shock. Hill and Viceisza (2010) use experimental methods to show that in a game setting, insurance induces farmers in rural Ethiopia to take greater, yet profitable risks, by increasing (theoretical) purchase of fertilizer.

While the impacts of insurance on *ex ante* risk management decisions are important, none of these papers is able to assess how an insurance payout directly influences the ability of poor households to recover after a shock. This paper represents one of the first attempts to fill this gap by studying the impact of insurance on *ex post* risk coping decisions. We do so by empirically analyzing whether the index-based livestock insurance contract in northern Kenya successfully functioned as a safety net by preventing costly coping strategies which might otherwise have crippled future productivity.

3 Research Setting and Data

This impact evaluation utilizes data from the index-based livestock insurance (IBLI) pilot project in northern Kenya's arid and semi-arid lands. This section provides background information about the research setting, the insurance pilot, and the available data including some summary statistics.

3.1 Drought Risk Among Pastoralists in Northern Kenya

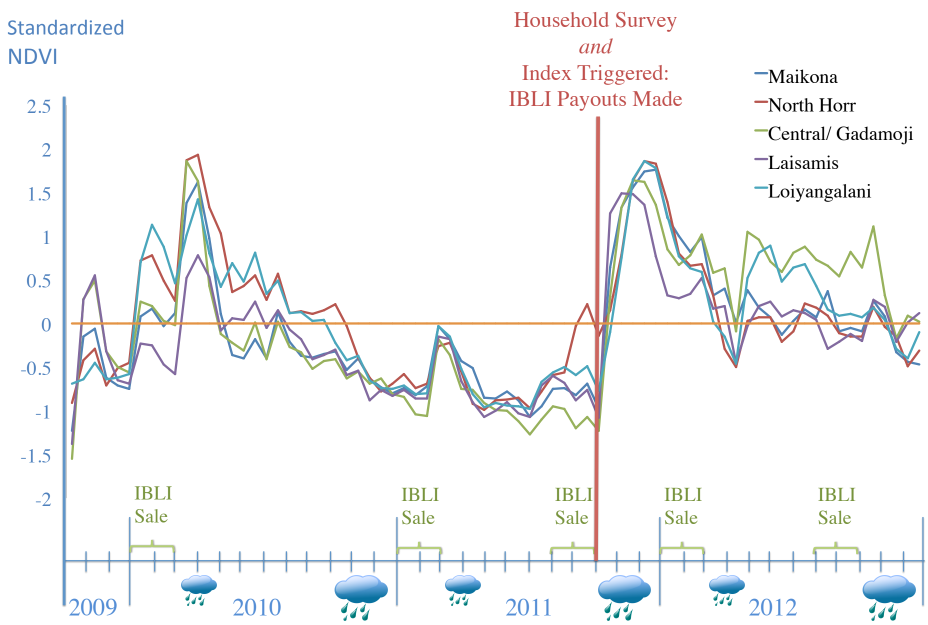
More than 3 million pastoralist households live in northern Kenya's arid and semi arid lands. The vast majority of these households rely on livestock for their primary livelihood. This setting is unique, because previous analyses of this livestock-dependent economy have provided strong empirical evidence of a poverty trap. Lybbert et al. (2004) and Barrett et al. (2006) use different data and methods to demonstrate nonlinear asset dynamics, such that when livestock herds fall below a critical threshold, recovery becomes difficult, and herds tend to move toward a low level equilibrium. Toth (2012) hypothesizes that these nonlinear asset dynamics are due to a critical herd size necessary to support mobility. Small herds are restricted to degraded rangelands near the town centers, where growth becomes challenging. This problem is compounded by an absence of formal credit markets: households can't take out a loan to reach the dynamic asset threshold, thereby moving onto a higher welfare path. Furthermore, Santos and Barrett (2011) show that access to informal credit is concentrated at the observed critical threshold. Thus, the persistently poor are consistently excluded from informal credit arrangements, further exacerbating the poverty trap mechanism.

When drought hits this region, households dependent on livestock must cope with large livestock losses. According to the data used for this paper, in the recent drought that devastated the Horn of Africa in 2011, families lost on average more than one third of their animals. As we have already highlighted, during and after a drought, cash-strapped food-insecure households often have limited options for coping with the harsh effects of drought, and the options available often undercut future productivity.

In January 2010 the index-based livestock insurance (IBLI) pilot project was launched in Marsabit District of northern Kenya as a collaborative project of the International Livestock Research Institute, Cornell University, Syracuse University and the BASIS Research Program at the University of California Davis in an effort to help pastoralists manage drought risk. The IBLI index insurance contract uses satellite-based NDVI (normalized difference vegetation index) measures of available vegetative cover to predict average livestock mortality experienced by local communities. The IBLI index has been shown to be highly correlated with actual livestock mortality losses experienced by pastoralists in the region (see Chantarat et al., 2010, 2012 for details). Households choose the number of livestock they wish to insure, with the contract expressed in tropical livestock units (TLU), so that a single annual contract accommodates the various livestock species common in the region: goats, sheep, cattle, and camels.[1] The premium households pay depends on the risk associated with the geographic region in which they live (Upper Marsabit is more susceptible to extreme drought, so households insuring in this region are required to pay a higher premium).

[1] In the IBLI contract, a goat or sheep is equal to .1 TLU, cattle are equal to a single TLU, and a camel is equal to 1.4 TLU.

Figure 1: Timeline of IBLI Sales, Payouts, Normal Rainy Seasons and Area NDVI



Insured households receive a payout at the end of each dry season, at the beginning of October and again early in March, if the predicted average livestock mortality rate reaches 15%, with the payout equal to the value of all predicted losses greater than 15%.

Figure 1 depicts the NDVI over time for each index area, where points above zero suggest above average vegetation, and points below zero indicate poor vegetative conditions. The rain clouds depict periods of normal rainfall, with the smaller cloud an indicator of the short rainy season, and the bigger rain cloud an indicator of the long rainy season. In late 2010, the long rains failed and the vegetative conditions on the ground fell below average. The situation deteriorated throughout much of 2011 as a harsh drought swept across the Horn of Africa. The cumulative effect of these below average conditions triggered the first IBLI payouts in October-November 2011, as the predicted livestock mortality rose above 15% in all five regions. These payouts were made to households who had purchased insurance earlier in the year. Households in our study received an average payout of about 10,000 Kenyan Shillings (or roughly $150).

3.2 Data

The data available includes household-level information collected annually (beginning in 2009) for 924 randomly selected households living in various sublocations across Marsabit district, all with access to IBLI. In each round of the survey, households were asked to answer questions about health, education, livestock holdings, herd migration, livelihood activities, income, consumption, assets, and access to credit. Each household also participated in an experiment to elicit their risk preferences. In the surveys following the baseline, households were also asked questions about insurance purchases, access to information about insurance, and tested on their level of insurance understanding.

Two levels of randomization occurred at the household-level. First, as part of an encouragement design, in each period 60% of surveyed households were randomly selected to receive coupons offering a 10-60% discount on the first 15 TLU insured. Second, some households were randomly selected to participate in experimental games, which were used as a means of communicating the complex concepts of index insurance. The games were designed to demonstrate the inter-temporal benefits of insurance by simulating herd dynamics over multiple seasons. They demonstrated that insurance would have to be purchased before the season began, and for each subsequent season that coverage was desired. In addition, the games conveyed that indemnity payments were triggered by droughts, that IBLI would not cover non-drought-induced losses, and that if a drought did not trigger payments, the premium would not be returned (see McPeak, Chantarat, and Mude, 2010 for details). Non-participants heard about IBLI from other participants, through village assemblies, by word of mouth or through local village insurance promoters.

Most of the data used for this analysis comes from the third round of the panel survey, completed in October-November 2011. The only exception are a few control variables which were assumed to have remained constant between the survey rounds. Included in this category are ethnicity, years of education of the household head, and risk aversion. Table 1 reports summary statistics on key variables disaggregated by whether a household was insured during 2011. All households had the opportunity to insure, but only 24% actually purchased insurance. Variables reported include the level of education of the household head, a dummy variable for whether a household is risk-taking or risk-moderate (as determined from an experiment eliciting risk preferences), the number of livestock owned, livestock losses in the past year, expected livestock losses in the next year and whether households indicated that it is difficult to acquire a loan. We also report summary statistics for a non-livestock asset index constructed from the first principle component using factor analysis. Variables used to generate the asset index include housing characteristics (such as materials used in the wall or for flooring in the house), cooking appliances, access to water, and possession of large assets such as a motorbike, boat, sewing machine, grinding mill or television. In addition, we show summary information on IBLI-specific variables of interest: dummy variables indicating that they participated in an experimental insurance game, and whether or not they received a discount coupon as well as its value. Because the discount coupon will be an important part of our identification strategy, we also report summary statistics for the same variables disaggregated by whether households received a discount coupon.

As we can see, the insured population appears relatively similar to the uninsured population with few observable statistically significant differences between the treatment and control. The encouragement design appears to have been effective, with the treated population being more likely to have received a coupon (and one of larger size). The game, on the contrary, is not strongly correlated with insurance adoption.

3.3 Strategies for Coping with Drought in Marsabit

The third round of the panel survey occurred around the same time as the October-November 2011 IBLI payout. At that time every household was asked about the ways in which they had been coping with the drought over the prior three months. Households were asked if they had engaged in specific behaviors, including selling livestock or reducing meals. They were then asked how they anticipated coping with the drought in the upcoming three months.

Table 1: Summary Statistics for Variables of Interest

	By Insurance Purchase			By Discount Coupon		
Variable	Insured	Uninsured	Difference in Means	Received Coupon	No Coupon	Difference in Means
Years of education,	.85	1.18	.340	1.07	1.17	.104
household head	(.21)	(.15)	(.293)	(.15)	(.21)	(.259)
Risk-taking	.25	.29	.036	.29	.27	-.011
(dummy=1 if risk-taking)	(.03)	(.02)	(.041)	(.02)	(.03)	(.036)
Risk-moderate	.50	.45	-.050	.45	.48	.036
(dummy=1 if risk-moderate)	(.04)	(.02)	(.045)	(.02)	(.03)	(.040)
Non-livestock asset index	.12	-.01	-.134	-.04	.13	.173**
(from factor analysis)	(.10)	(.04)	(.094)	(.04)	(.08)	(.083)
Number of TLU Owned	12.49	11.86	-.631	11.85	12.28	.427
	(1.11)	(.64)	(1.29)	(.61)	(1.08)	(1.147)
Number of TLU losses	7.54	7.64	-.101	7.71	7.46	-.244
in past year	(.87)	(.50)	(1.02)	(.56)	(.69)	(.903)
Number of Expected TLU	6.99	7.46	.466	7.71	6.73	-.983
losses in next year	(.61)	(.36)	(.732)	(.39)	(.52)	(.647)
Credit Constrained[a]	.42	.38	-.041	.42	.33	-.084**
(dummy=1 if true)	(.04)	(.02)	(.044)	(.02)	(.03)	(.039)
Participated in IBLI game	.27	.24	-.029	-	-	-
(dummy=1 if true)	(.04)	(.02)	(.039)			
Received IBLI discount coupon	.88	.56	-.319***	-	-	-
(dummy=1 if true)	(.03)	(.02)	(.042)			
Value of IBLI discount coupon	23.79	16.52	-7.27***	-	-	-
(of: 0, 10, 20, 30, 40, 50, 60)	(1.83)	(.96)	(1.98)			

Standard errors, including the standard errors of the difference in means, are reported in parentheses.
For the difference in means tests: *** p<0.01, ** p<0.05, * p<0.1.
[a] A household is classified as credit constrained if they say it's difficult to acquire a loan.

Insured households were asked this second question after being told exactly how much they should expect to receive as an insurance payment if they hadn't already received one. Most payouts were received within days or weeks of the survey, but a few households had already received the payout.

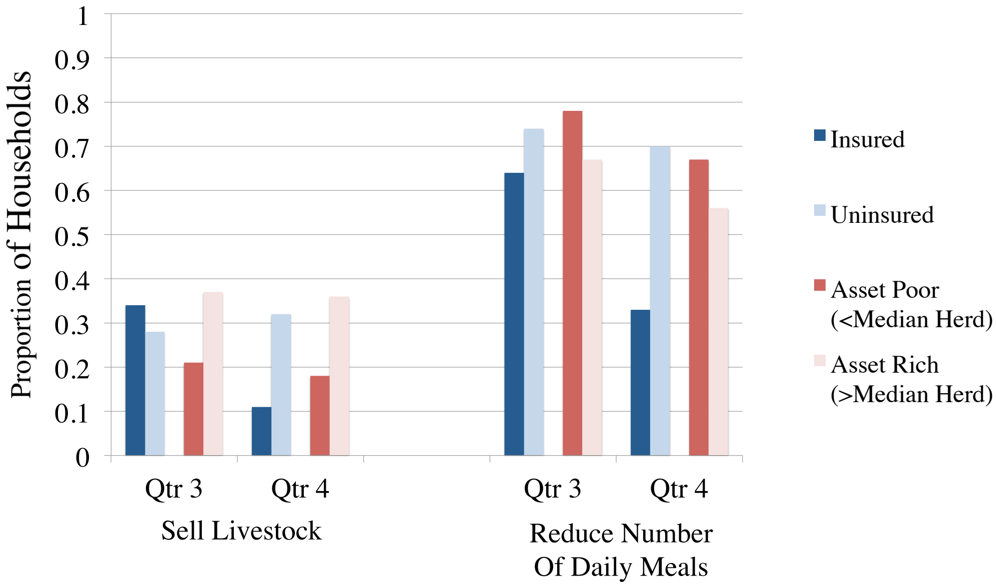
As discussed in Section 1, the literature on poverty traps predicts that poor households near and below a critical asset threshold will hold onto their main productive assets (livestock), forgoing critical consumption. Wealthier households will instead destabilize assets in order to better smooth consumption. As a first step to understanding whether this theoretical prediction is observed in our sample, we arbitrarily split the sample into asset poor households with livestock holdings below the median herd size (7.3 TLU), and asset rich households with livestock holdings greater than the median herd. Using this loosely constructed definition of asset rich and asset poor households, which we later refine, we compare the proportion of both asset poor and asset rich households that indicated they had, or expected to soon 1) sell livestock or 2) cut back on the number of daily meals eaten, in order to cope with the drought. Figure 2 shows that asset poor households were *less* likely to have sold (or expect to sell) livestock and much *more* likely to have reduced (or anticipate reducing) the number of meals eaten each day. Asset rich households, on the other hand, were *less* likely to cut back (or expect to reduce) on consumption, and *more* likely to have sold (or anticipate selling) livestock. A difference in means test reveals that in both periods and for both behaviors, the difference in behaviors between asset poor and asset rich households is statistically significantly different from zero at the 1% level. These findings provide strong evidence of asset smoothing by those with small livestock holdings and consumption smoothing by those with large herds.

Our main results are based on these anticipated behavioral changes after receipt of the October 2011 insurance payouts. By comparing the immediately anticipated behavioral changes made by insured households with those of their uninsured peers, we can measure the immediate impact of drought insurance on household well-being. Figure 2 also shows the proportion of both insured and uninsured households that indicated they had, or expected to soon sell livestock or cut back on the number of daily meals eaten, in order to cope with the drought. Substantial majorities of both insured and uninsured households cut back on meals to deal with the drought. Roughly a third in each group sold livestock from their already diminished herds. A coarse assessment suggests that many insured households drastically anticipate reducing their reliance on both of these costly coping strategies.

The data also supports comparison of insured and uninsured households' coping strategies in the 3rd quarter of 2011, prior to receiving an insurance payout, to the uninsured population. A difference between the two is most likely to reflect an intrinsic difference between insured and uninsured households, indicating the potential for endogeneity bias in our estimation of impacts. We find that there is a statistically significant difference: insured households are less likely to have reduced the number of meals eaten each day in the 3rd quarter of 2011. These differences (and economic intuition) force us to think critically about the endogeneity of the insurance purchase.[2]

[2]A difference in 3rd quarter strategies may also reflect the fact that insured households are coping differently in anticipation of a payout, as we would expect if insurance stimulates *ex ante* behavioral changes). We analyze these potential impacts of insurance in Section 6.

Figure 2: Summary of Coping Strategies during the 2011 Drought in Marsabit



4 Estimation Strategy

Our empirical strategy for estimating the impact of insurance in northern Kenya accounts for two key issues highlighted in the previous section: endogeneity of the decision to insure, and the potential existence of a threshold around which coping strategies bifurcate. Each of these issues are discussed below.

4.1 Estimating the Average Impact of Insurance

Ideally, we would like to compare a cohort of households randomly assigned to an insurance "treatment" with a control group without access to insurance. Although IBLI was implemented in connection with an integrated impact evaluation which includes a treatment and control region (with and without access to IBLI, respectively), the nature and timing of surveys varies across these two different regimes. This difference limits our ability to use the pure control group to assess the immediate impacts of the 2011 insurance payout on the ability of households to cope with the shock *ex post*. Instead, for this analysis we are limited only to a population in which all households had the opportunity to insure their livestock, though not all households chose to do so. Since households must self-select into purchasing insurance, we must account for selection bias in the analysis.

In the absence of randomized treatment assignment, a variety of techniques exist to control for selection bias. These methods vary according to the underlying assumptions that must be made to use them. Because the endogenous decision to insure is likely to depend on unobservables, our preferred estimates are based on an instrumental variables (IV) approach. Using IV, selection bias on unobservable characteristics is corrected through the use of an appropriate instrument.

The encouragement design implemented with IBLI provides three potentially suitable instruments: participation in an insurance game, receipt of an insurance coupon and the subsequent value of the discount coupon. All are the result of randomization, so none should be correlated with coping strategies, but we expect all to be highly correlated with insurance uptake. Table 1 suggests that the coupon (both receipt of and value) is indeed highly correlated with the decision to insure, and thus constitutes a good instrument. Unfortunately, participation in the insurance game is not as highly correlated with insurance uptake as we might expect, and turns out to be a weak instrument. Table 1 also checks the balance of the covariates, to ensure that the receipt of the coupon was indeed random. Although coupons were distributed at random, it seems that households who received discount coupons may be less wealthy and find it more difficult to obtain a loan.

Using IV we obtain the local average treatment effect of insurance on coping strategies. To obtain this effect, we estimate the following first stage regression equation, where I_i is an indicator variable equal to 1 if a household purchased insurance, Z_i is a vector of instrumental variables (including receipt and value of coupon), and X_i is a vector of covariates that influence a household's drought-coping behavior:

$$I_i = Z_i\, \delta + X_i\, \theta + v_i \tag{1}$$

We then estimate the impact of insurance (β) on household coping strategies in the following second stage regression where predicted insurance uptake ($\widehat{I}_i$) was obtained from the first stage equation.

$$y_i^Q = \beta \, \widehat{I}_i + X_i \, \phi + \varepsilon_i \tag{2}$$

The superscript Q for the dependent variable y_i^Q distinguishes between coping strategies in the 3rd and 4th quarter. Our main results consider the impact of insurance on 4th quarter coping strategies, but Section 6 also estimates the impacts on pre-payout behaviors.

Because the assumptions necessary for IV are minimal given the available data, this is our preferred approach. However, several alternatives to IV exist. The appendix considers the use of both a Heckman Selection Model and Matching methods. The results do not change substantially if we use either of these approaches.

4.2 A Threshold-based Approach

Figure 2 provides observational evidence of a potential threshold-differentiated behavioral response in our sample. If a household's response to the drought depends on a critical threshold, it seems likely that the impact of insurance, at least for livestock sales and consumption, will also vary depending on whether a household is above or below the threshold. Moreover, ignoring the threshold may actually produce a weighted average of the true impacts. Our hypotheses regarding the threshold-disaggregated impacts of insurance are as follows: asset rich households are more likely to smooth consumption, and thus more likely to actually destabilize their asset stocks during a shock. Hence, we expect insurance will help asset rich households to better protect their assets. Asset poor households, on the other hand, are typically unwilling to part with their productive assets because they rely so heavily on them in meeting future needs. These households instead choose to forgo food consumption. We thus expect that insurance will help asset poor households to better smooth consumption during a shock.

Following Carter and Lybbert (2012), we explore these differential impacts of insurance on behavior by using Hansen's threshold estimation technique (Hansen, 2000) to test for the presence of a critical asset (livestock) threshold that splits our sample into two meaningfully different behavioral regimes based on a household's recent coping strategies. If a threshold is determined to exist, its location, A^*, is estimated and used to separate the sample into two regimes: asset poor households with fewer than A^* assets, and asset rich households who own A^* or greater assets. The threshold disaggregated impacts of insurance (β_{low} and β_{high}) are then estimated as follows:

$$y_i^Q = \begin{cases} \beta_{low}\ \widehat{I}_i + X_i\ \phi_{low} + \varepsilon_{i,low} & \text{if } A_i \leq A^* \\ \beta_{high}\ \widehat{I}_i + X_i\ \phi_{high} + \varepsilon_{i,high} & \text{if } A_i > A^* \end{cases} \quad (3)$$

where $\widehat{I}_i$ is the same as before and A_i is within vector X_i.

5 Ex Post Impacts of Insurance

In this section we present the results of the impact analysis using IV. We present both population *average* impacts and threshold-disaggregated impacts. The details of the first stage probit selection equation used to obtain IV estimates are provided in Table 2. Because we use probit for the first stage regression, we report the Wald test for joint significance of the two instruments: receipt and value of the IBLI discount coupon. Each of these were the result of randomization, so we can be reasonably certain that they do not influence a household's response to the drought, except through the purchase of insurance. Although participation in the IBLI game was a potential instrument, if included it is not statistically significant from zero, and is not jointly significant with the other two instruments. For this reason it has been excluded.

We focus on the impact of insurance on two primary outcomes of interest: *expected*

Table 2: Demand for Insurance: First Stage Probit Selection Regression

	(1)
Received IBLI discount coupon *(instrument #1)*	1.466***
	(0.203)
Value of IBLI discount coupon *(instrument #2)*	-0.004
	(0.004)
Years of education (head)	-0.040
	(0.025)
Risk-taking	0.175
	(0.159)
Risk-moderate	0.205*
	(0.124)
Non-livestock asset index	0.221**
	(0.086)
TLU Owned	0.007
	(0.005)
TLU losses in past year	-0.000
	(0.005)
Expected TLU losses	-0.005
	(0.009)
Credit Constrained	0.041
	(0.119)
Ethnicity fixed effects	yes
Location fixed effects	yes
Observations	662
Pseudo R^2	0.261
Wald test for joint significance of instruments	84.18

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

livestock sales and *expected* reduction in the number of daily meals consumed. The results are presented for both outcomes in Table 3. Columns (1) and (4) show the population average impacts for livestock sales and meal reductions, respectively. Columns (2)-(3) and (5)-(6) present the threshold-disaggregated impacts.

Hansen's threshold estimator applied to anticipated livestock sales and meal reduction in quarter 4 yields a threshold estimate near the median herd size (which is 7.3 TLU) of $A^* = 8.4$ TLU using livestock sales or $A^* = 5.5$ TLU using daily meal reduction. Figures 3a and 3b demonstrate the confidence intervals around the estimated threshold estimates. Both estimates are significant at the 1% level, so we are very confident that households above and below this threshold responded differently to the drought experienced in 2011. This finding adds to a growing body of evidence that pastoralist households in northern Kenya are indeed responding to a critical threshold.

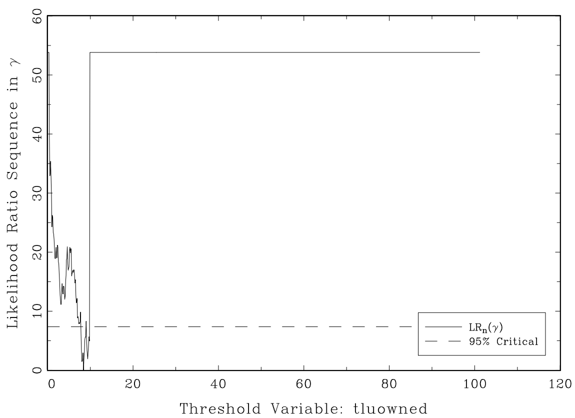
5.1 Impact on Livestock Sales

This section considers the impact of insurance on curbing the sale of productive assets. The results presented in Table 3 suggest that the expectation of an insurance payout substantially reduces the probability that a household intends to sell livestock. The average impact results presented in Column (1) imply a 36 percentage point reduction in the number of households who anticipated selling further livestock to cope with the 2011 drought. This represents an overall reduction of about one half, relative to previous behavior.

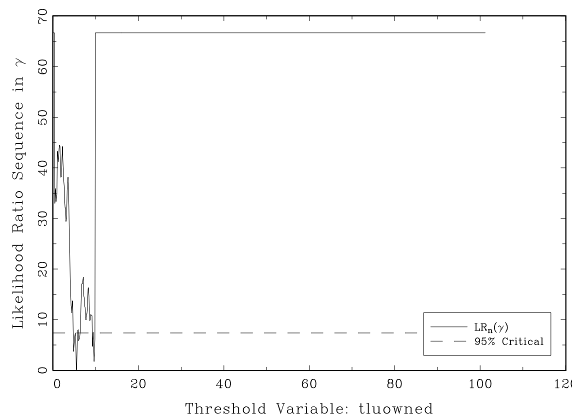
The threshold-disaggregated results suggest that the benefits of insurance on asset protection are largely driven by the behavior of asset rich households. Column (2) suggests a small statistically insignificant impact of insurance for poor households who are already smoothing assets to the best of their ability. However, Column (3) shows that asset rich households are 64 percentage points less likely to plan on selling livestock. These results suggest that insurance helps stop the households prone to give up productive assets from engaging in that costly coping strategy which would otherwise damage their productive asset

Figure 3: Threshold Estimation

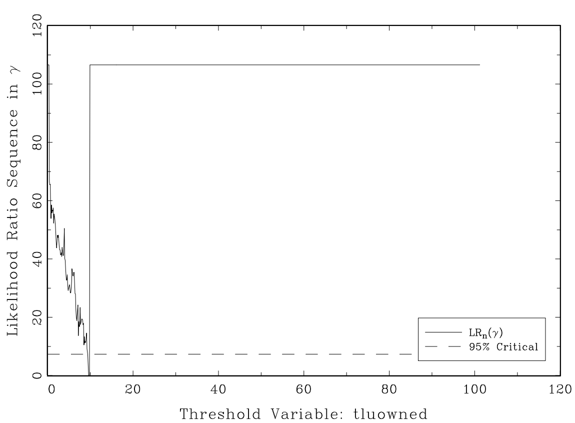
(a) Post-Payout Asset Smoothing



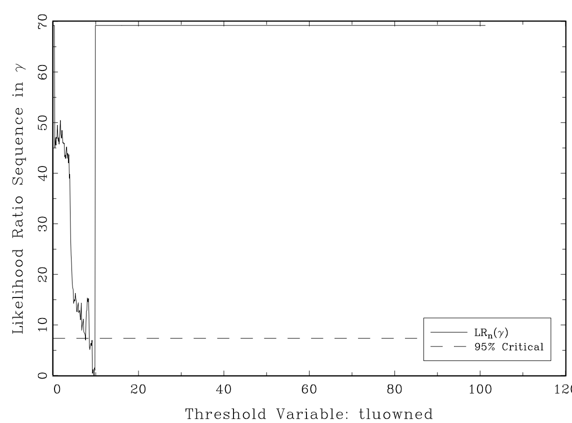
(b) Post-Payout Consumption Smoothin



(c) Pre-Payout Asset Smoothing



(d) Pre-Payout Consumption Smoothing



base, harming the household's future income-earning potential.

5.2 Impact on Consumption

When poor households endeavor to maintain scarce productive assets during a shock, it often imposes a high cost on consumption. Here, we consider the impact of an insurance payout on daily household consumption. The results can be found in Table 3. Focusing on the local average treatment effect in Column (4), insurance (and receiving an insurance payout) results in a 25 percentage point drop in the number of households that anticipate decreasing the number of meals eaten each day when under stress from a drought. Overall, this is a reduction of about one third. This result suggests that insurance improves food security; insured households are much less likely to be malnourished or undernourished during a drought.

Columns (5)-(6) show that the magnitude of the insurance impact is larger for asset poor households when we consider anticipated consumption destabilization. That is, poor households, who are most likely to destabilize critical consumption, are 43 percentage points less likely to reduce the meals eaten in their household when an insurance payout is received. The impact of insurance on expected consumption destabilization for richer households is much smaller, and not statistically significantly different from zero. But that's not surprising because richer households are less likely to cut back on meals in the first place. Instead, insurance helps protect the most vulnerable households from undernutrition and malnutrition, and their harmful long-term consequences. In this way it seems that insurance does indeed provide a valuable alternative to coping with negative shocks, allowing smoothing of consumption and nutrition, while preserving productive assets.

5.3 Multiple Hypotheses Test

In this section we have tested multiple hypotheses. Intuitively, the more hypotheses we check, the higher the probability of making a Type I error. The Bonferroni-Holm method is one way

Table 3: Threshold-Disaggregated Ex Post Behavioral Impacts of Insurance

	Impact #1 Sell Livestock			Impact #2 Reduce Meals		
	(1)	(2)	(3)	(4)	(5)	(6)
	Average	Asset Poor < 8.4 TLU	Asset Rich > 8.4 TLU	Average	Asset Poor < 5.5 TLU	Asset Rich > 5.5 TLU
$\widehat{insured}$	-0.359***	-0.211	-0.644***	-0.247**	-0.430**	-0.167
	(0.114)	(0.133)	(0.190)	(0.121)	(0.166)	(0.181)
Years of education (head)	-0.001	-0.008	0.011	0.000	0.001	-0.001
	(0.005)	(0.006)	(0.009)	(0.007)	(0.010)	(0.010)
Risk-taking	0.036	0.048	0.015	-0.075	-0.060	-0.120*
	(0.045)	(0.056)	(0.068)	(0.049)	(0.074)	(0.061)
Risk-moderate	-0.013	-0.003	-0.036	-0.011	-0.034	-0.036
	(0.040)	(0.051)	0.062	(0.046)	(0.074)	(0.057)
Non-livestock asset index	0.0123	0.041	-0.027	-0.059**	-0.044	-0.071*
	(0.023)	(0.027)	(0.043)	(0.024)	(0.037)	(0.033)
TLU Owned	0.006***	0.029***	0.004**	0.000	0.011	-0.001
	(0.001)	(0.009)	(0.002)	(0.001)	(0.015)	(0.001)
TLU losses in past year	0.003	-0.001	.0004**	-0.003	-0.012***	-0.001
	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)	(0.002)
Expected TLU losses	-0.004*	0.002	-0.008***	0.003	-0.012***	0.007***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.004)	(0.002)
Credit Constrained	0.027	0.087**	-0.006	0.055	0.058	0.048
	(0.034)	(0.041)	(0.055)	(0.037)	(0.053)	(0.051)
Ethnicity fixed effects	yes	yes	yes	yes	yes	yes
Location fixed effects	yes	yes	yes	yes	yes	yes
Observations	662	359	303	662	286	376
R^2	0.164	0.121	0.263	0.172	0.200	0.260

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

to address this issue of a familywise error rate. We conduct the Bonferroni-Holm test using the calculated p-values for each of the threshold-disaggregated insurance impact coefficients. Using this method, we fail to reject the null hypothesis of joint significance for the key ex post impacts of insurance: insurance improves the ability of asset rich households to smooth assets, and strengthens the capacity of asset poor households to smooth consumption.

6 Semi Ex Ante Behavioral Impacts

In addition to the ex post behavioral adjustments made upon receipt of a payout, we are able to measure a semi ex ante impact of insurance as households alter behaviors in anticipation of a payout. Unlike previous analyses of ex ante impacts which have focused on ex ante risk management behaviors, these ex ante impacts consider ex post risk coping strategies, but are semi ex ante in the sense that we now consider the impact of insurance on consumption and asset smoothing behaviors prior to receipt of a payout.

For example, we might expect an insured asset poor optimizing pastoralist household to cut back on meals less than his uninsured counterpart if he expects a payout to help him smooth consumption in the near future. However, this ex ante behavioral adjustment will be made only if households fully expect a payout to be made in a timely manner. In focus group interviews researchers were told over and over again that households were "waiting to see what happens," indicating a lack of trust in the product until a payout was actually observed. It therefore seems likely that many households would be unwilling to adjust behaviors until a payout was actually received. If households do adjust their behaviors, the impact should be smaller than the ex post impact presented in Table 3.

We estimate the impact of insurance on consumption and asset smoothing behaviors prior to receipt of the payout. The threshold estimates are once again statistically significant and relatively similar to previous estimates: $A^* = 9.7$ TLU with respect to livestock sales or $A^* = 9.6$ TLU with respect to meal reduction. Because these threshold estimates are based on actual behavior (rather than stated intentions) we are even more confident that a household's response to drought depends on their livestock holdings and a critical asset threshold.

The results are presented in Table 4. The estimated impacts on livestock sales are not significantly different from zero. This is true whether we consider average impacts or threshold-disaggregated impacts. These findings suggest that households are not currently altering their optimal livestock marketing strategies on account of insurance prior to receipt of a payout. Rather, behavioral adjustments are only made once a payout has been received. This may reflect a lack of trust in the product, and supports the idea that people truly are "waiting to see what happens."

On the contrary, Table 4 provides some evidence of ex ante consumption smoothing in anticipation of a payout. Not surprisingly, these ex ante impacts on consumption smoothing are smaller than the ex post impacts presented earlier. On average, the impact is significant at the 10% level, and the evidence suggests that these ex ante behavioral adjustments are being made primarily by asset poor households.

However, using the Bonferroni-Holm method, we reject the null hypothesis of joint significance, revealing that the ex ante impact on consumption smoothing may suffer from a Type I error. Although theory suggests that households will make behavioral adjustments, we would also not be surprised to know that households are simply "waiting to see what happens," due to a lack of trust. In this way, our findings regarding ex ante behavioral changes are inconclusive. In fact, if we truly believe that households are "waiting to see what happens," then the semi ex ante impacts presented in this section provide a useful placebo test. By rejecting the null of join significance here, the estimated ex post impact results presented in Section 5 become even more believable.

Table 4: Threshold-Disaggregated Ex Ante Behavioral Impacts of Insurance

	Impact #1 Sell Livestock			Impact #2 Reduce Meals		
	(1)	(2)	(3)	(4)	(5)	(6)
	Average	Asset Poor < 9.7 TLU	Asset Rich > 9.7 TLU	Average	Asset Poor < 9.6 TLU	Asset Rich > 9.6 TLU
$\widehat{insured}$	-0.063	-0.043	-0.076	-0.197*	-0.295**	-0.155
	(0.109)	(0.128)	(0.184)	(0.111)	(0.128)	(0.207)
Years of education (head)	-0.000	-0.003	0.005	-0.003	-0.000	-0.010
	(0.005)	(0.007)	(0.008)	(0.006)	(0.006)	(0.012)
Risk-taking	0.003	0.068	-0.067	-0.042	0.048	-0.190***
	(0.046)	(0.053)	(0.072)	(0.046)	(0.057)	(0.069)
Risk-moderate	-0.043	0.006	-0.126*	-0.000	0.051	-0.085
	(0.041)	(0.048)	(0.064)	(0.042)	(0.053)	(0.066)
Non-livestock asset index	0.036	0.056*	-0.031	0.001	0.006	0.036
	(0.024)	(0.029)	(0.045)	(0.024)	(0.028)	(0.049)
TLU Owned	0.004***	0.014*	0.005**	-0.001	0.010	0.001
	(0.001)	(0.007)	(0.002)	(0.001)	(0.007)	(0.002)
TLU losses in past year	0.001	0.006	0.002	-0.003	-0.006	-0.003
	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)	(0.002)
Expected TLU losses	-0.004*	0.010***	-0.012***	0.003	-0.010***	0.014***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
Credit Constrained	-0.050	0.056	-0.189***	0.127***	0.094**	0.124**
	(0.035)	(0.043)	(0.058)	(0.034)	(0.040)	(0.059)
Ethnicity fixed effects	yes	yes	yes	yes	yes	yes
Location fixed effects	yes	yes	yes	yes	yes	yes
Observations	662	392	270	662	389	273
R^2	0.200	0.189	0.353	0.165	0.189	0.256

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

7 Conclusion

When adverse shocks strike in developing countries, poor households are often forced to choose between drawing down productive assets or human capital. Either way, uninsured risk can result in permanent consequences if the household's choice undermines its future productivity. In this paper we assess whether insurance can function as a safety net, preventing household asset depletion and improving the human capital of future generations.

Our findings suggest that IBLI payouts in Marsabit district of northern Kenya during the drought of 2011 provided substantial immediate benefits to insured households. On average, insured households who receive a payout are much less likely to sell livestock, improving their chances of recovery. Insured households on average also expect to maintain their current food consumption, rather than reduce meals like their uninsured neighbors.

We also show that households in our sample do indeed behave differently depending on their asset holdings and a critical asset threshold. Livestock-poor households were more likely to smooth assets, whereas livestock-rich households were more likely to smooth consumption during the drought experienced in 2011. This finding adds to a body of empirical evidence which suggests the presence of a poverty trap in this setting. It also indicates that simply estimating the average effect of insurance may mask an interesting heterogenous impact of insurance. Recognizing that a household's response to drought depends on a critical asset threshold, we show that the impact of insurance also depends on the critical behavioral threshold. Our results suggest that insurance helps stop the households most likely to give up productive assets from reducing their asset base, otherwise harming the household's future income-earning potential. In addition, insurance helps prevent those households most likely to reduce consumption from doing so, thereby protecting vulnerable household members from undernutrition and malnutrition, and improving the human capital of future generations.

Considered jointly, these impacts imply that insurance functions as a safety net, allowing smoothing of consumption and nutrition, while preserving productive assets. In this way, insurance promotes asset smoothing without having the deleterious long term consequences of destabilized consumption.

These results come at a critical time for policymakers. There has recently been a grand push from development agencies to scale up microinsurance pilots with the goal of reaching a larger number of households. This push has transpired in spite of an incomplete understanding of microinsurance impacts. This results presented here provide some of the first empirical evidence that insurance can improve outcomes when negative strikes occur. We recognize that our main results are based on immediate expectations regarding a specific insurance pilot project, and are therefore not immediately generalizable. Indeed, further impact analyses will help to generalize the results more broadly. However, this research provides an important first step. If the declared intentions of pastoralists in northern Kenya closely follow their true behavior, which we believe they will, then the highly anticipated long term positive welfare impacts of IBLI and other similar microinsurance projects are likely to be observed in the near future.

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Appendix: Alternative Estimation Approaches

In addition to using instrumental variables, a variety of techniques can be used to control for selection bias. Empiricists often begin with a Heckman selection model, which controls for selection bias and can also inform our beliefs about the importance of selection bias. For this approach we calculate an inverse Mills ratio using the estimated parameters of the first stage probit regression of the insurance decision. This ratio captures the part of the unexplained variation v_i that is correlated with sample selectivity. We then include the inverse Mills ratio as an additional explanatory variable in a second stage regression estimating the average impact of insurance on consumption and asset smoothing. If the estimated coefficient for the inverse Mills ratio is different from zero, then we should be concerned about selection bias. Columns (1) and (4) of Table 5 show the average impacts using the Heckman correction method. The results are similar to our earlier findings, and remain highly statistically significant. The inverse Mills ratio is not statistically significant, indicating that selection bias may be less of a problem than we might otherwise worry about.

Another potentially useful approach is to use matching methods. This approach requires an assumption that unobserved factors do not affect participation. If we can control for all the factors that affect participation, then matching provides consistent estimates of the impact of insurance. Matching estimates are obtained by finding a pair of households who appear similar (based on observed characteristics), with one household purchasing insurance while the other did not. The estimated impact of insurance is obtained by taking the average difference in outcomes between pairs. A number of matching methods exist. Columns (2) and (5) of Table 5 present the results for nearest neighbor matching in which households are matched based on wealth, livestock holdings, ethnicity and location. This is a practical approach since ethnicity and location are important in defining a household's identity in this region. The results are similar and remain highly statistically significant.

A primary limitation of our study is that it relies on household expectations about the future. There is no way we can improve upon this limitation in the data. Nonetheless, expectations could be largely dependent on how an enumerator framed the questions. For example, we might be concerned about the following: Did some enumerators ask the questions about coping strategies in a way that encouraged a dramatic response by insured households? In many instances, the enumerator was the person who informed the insured household that a payout was to be made, and the amount the household should expect to receive. For this reason we test whether our results, based on expectations, are sensitive to enumerator effects. This method isn't perfect: there is a strong correlation between the enumerator and the household's location and ethnicity, mainly due to language and cultural barriers.[3] For this reason, we are only able to estimate the average impact on ex post consumption and asset smoothing behaviors using enumerator fixed effects in place of location and ethnic fixed effects, and even so the model appears to suffer from multicollinearity such that the coefficients should be treated with caution. Nonetheless, these estimates are reported in Table 5 as well. We find that including enumerator fixed effects does not substantially alter our results regarding the impact of insurance on asset protection, but it does substantially increase the explanatory power. However, the estimate of the insurance impact on household consumption (Impact #2) is much smaller and becomes insignificant when enumerator fixed effects replace location and ethnicity fixed effects.

However, if we are worried that the expectations are in some way invalid because they are driven by framing effects, then our best robustness check is actually presented as part of our main results. It is very unlikely that we would observe distinct threshold-disaggregated behavioral responses if the responses were truly driven by framing effects. Because these empirical results match our expectations from theory, we have great confidence that the anticipated behaviors are informative.

[3]Enumerators, who could usually speak only 1 or 2 local dialects, were divided into 5 teams for the survey implementation. Each team was sent to a different region with certain cultural and language characteristics.

Table 5: Estimated Ex Post Impacts Using Alternative Methods

	Impact #1 Sell Livestock			Impact #2 Reduce Meals		
	(1)	(2)	(3)	(4)	(5)	(6)
	Heckman Correction Method	Nearest Neighbor Matching	Enumerator Fixed Effects	Heckman Correction Method	Nearest Neighbor Matching	Enumerator Fixed Effects
insured	-0.268***			-0.374***		
	(0.063)			(0.064)		
Inverse Mills Ratio	0.229			-0.187		
	(0.325)			(0.228)		
ATE (*Matching*)		-0.306***			-0.371***	
		(0.052)			(0.064)	
$\widehat{insured}$			-0.395***			-0.094
			(0.139)			(0.097)
Years of education (head)	-0.001		-0.003	0.000		0.008
	(0.007)		(0.006)	(0.008)		(0.007)
Risk-taking	0.036		0.050*	-0.075**		-0.043
	(0.036)		(0.026)	(0.034)		(0.040)
Risk-moderate	-0.013		0.027	-0.012		-0.026
	(0.029)		(0.038)	(0.050)		(0.052)
Non-livestock asset index	0.014		0.011	-0.058*		-0.075**
	(0.018)		(0.018)	(0.027)		(0.031)
TLU Owned	0.006***		0.006***	0.000		-0.001
	(0.001)		(0.002)	(0.001)		(0.001)
TLU losses in past year	0.003		0.004*	-0.003**		-0.003
	(0.002)		(0.002)	(0.001)		(0.002)
Expected TLU losses	-0.004*		0.003	0.003		0.001
	(0.002)		(0.003)	(0.003)		(0.004)
Credit Constrained	0.029		-0.010	0.057		0.016
	(0.074)		(0.038)	(0.063)		(0.050)
Ethnicity fixed effects	yes	-	no	yes	-	no
Location fixed effects	yes	-	no	yes	-	no
Enumerator fixed effects	no	-	yes	no	-	yes
Observations	662	673	642	662	673	642
R^2	0.215	-	0.360	0.251	-	0.368

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1