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Index-based insurance: Lottery ticket or insurance?

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Key points

Index-based insurance continues to be promoted as an effective approach for offering formal insurance to rural households in developing countries while little has been done to assess the risk coverage provided by such products. Products with poor quality could increase risk—in a manner very similar to a lottery ticket—rather than reduce it—as the term 'insurance' implies. Currently, there is little empirical evidence to support the insurance label used by designers, promoters and vendors of index insurance.

The Index-Based Livestock Insurance (IBLI) product, piloted in northern Kenya and southern Ethiopia since early 2010, is implemented with an accompanying research program that allows for a first-ever analysis of index insurance quality in a developing country context. This brief draws on an analysis of the IBLI product in Marsabit by Jensen, Barrett and Mude (2015). Our key findings include:

- Although drought is by far the largest killer of livestock, there is a great deal of variation in livestock mortality rates among households, even during droughts.
- This idiosyncratic risk, specific to an individual and not captured by the experiences common to all people in the area, cannot be covered by index insurance products, which offer coverage only for covariate risks – the average experience common to all people in the area.
- IBLI successfully provides coverage for 63% of the covariate risk faced by pastoralists, a very significant share.
- Utility simulations show that households are better off with IBLI coverage than without, even under the commercially loaded and unsubsidized rate, implying that IBLI provides considerable risk coverage as opposed to offering households access to a lottery.

Introduction

Environmental shocks are drivers of poverty as well as a fact of life in many rural areas of the developing world. In the developed world, agricultural insurance provides some protection from such calamities. But conventional insurance products have not reached many rural households in developing countries due to the high costs of gathering information relative to the size of policies demanded and well-known moral hazard, and adverse selection issues that complicate product design and pricing.

Recently, there has been much excitement around the use of index-based insurance, as an alternative to conventional insurance products, to extend the rural poor's access to formal insurance coverage in developing countries (Alderman & Haque 2007; Barnett, Barrett & Skees 2008; Mahul & Stutley 2010). Index insurance provides indemnity payments based on a signal that is related to covariate losses rather than actual and observed individual losses. When signals are chosen properly—those that are easy to observe in near-real-time, exogenous to the behaviours and characteristics of both the insurer and insurees, and highly correlated with the insured risk—suppliers of index insurance face much lower costs associated with adverse section, moral hazard monitoring, and validation of claims than they would if they were offering conventional policies.

For instance, seasonal precipitation is highly correlated with average maize yields in some areas. In those cases, an index insurance product developed using area-average seasonal precipitation may offer maize growers protection against low maize yields associated with precipitation. Premium and indemnity rates for such products are calculated in relation to estimates of precipitation, rather than household-level losses, so that an individual's characteristics and actions have very little or no effect on either. For providers of index insurance, there is no need to collect individual level data for setting premiums, validating claims or monitoring for moral hazard.

Growing enthusiasm for index insurance among researchers and development and humanitarian organizations has led to a proliferation of pilot projects across the globe. For example, interest in supporting index insurance as a development tool led to the formation of the Global Index Insurance Facility in 2009, which has now supported projects that have insured more than 600,000 farmers (GIIF 2014).

Basis risk, or the risk that insured households continue to face after purchasing an index insurance contract, is a widely recognized Achille's heel of these new products and is thought to be quite sizable by some (e.g. Miranda & Farrin 2012). Such basis risk arises due to variation between farmers, leading to inevitable differences between the individual losses and average losses (idiosyncratic risk), as well as differences between the index and actual average losses (design risk). Until now, however, there have been very few empirical studies of the magnitude of basis risk associated with index insurance products for smallholder agriculturalist households in developing countries. No pilot project to date appears to have examined how insured individuals' actual losses correlate with the index on which the index insurance contract is based. If that correlation is weak, index insurance offers little risk coverage; indeed if the correlation is negative, it may increase the risk that some insurees face. For those households, index insurance represents a gamble in spite of the 'insurance' label – they pay a fee for the chance of a payout but also increase the variance of their stochastic income. Commercially loaded index insurance, for which the premium exceeds the actuarially fair price in order to cover the insurer's costs, can therefore be more like a lottery ticket than an indemnity insurance policy for some households. Without careful empirical analysis we do not know where index products fall on the spectrum between full risk coverage and lottery tickets, and for which clientele.

Unfortunately, the general enthusiasm for index insurance has not been accompanied by parallel investments to ascertain the quality or extent of the coverage offered by index products and the remaining basis risk that insurees continue to bear. In response to this need, Jensen, Barrett and Mude (2015) studied the distribution of basis risk associated with the IBLI product in northern Kenya. Specifically, we decompose basis risk into its idiosyncratic and design components to better understand how the IBLI product could be improved and then examine if IBLI benefits those that purchase coverage.

IBLI in Marsabit, Kenya

IBLI was launched in Marsabit, Kenya in January 2010 to insure pastoralists against livestock mortality associated with drought. The insurance policy payouts are determined by an index of predicted division-average livestock mortality rates. At the time of this research, IBLI used an index that was developed using statistical methods to relate historic livestock mortality to remotely sensed Normalized Differenced Vegetation Index (NDVI) measures and minimized basis risk (Chantarat, et al. 2013).[1]

We used four rounds of data from an annual household longitudinal survey (2009-2012) and IBLI index values to study the distribution of basis risk associated with IBLI across eight insurance seasons.[2] Decomposing household risk into covariate and idiosyncratic components, we found that Marsabit pastoralists face a great deal of idiosyncratic risk that cannot be covered with an index insurance product. This is surprising in this population for which severe drought—a covariate phenomenon—is recognized as being the greatest source of risk. Furthermore, regression analysis of idiosyncratic losses finds that such losses are mostly random and are unrelated to observed household characteristics or heterogeneity between communities within index regions.

Basis risk

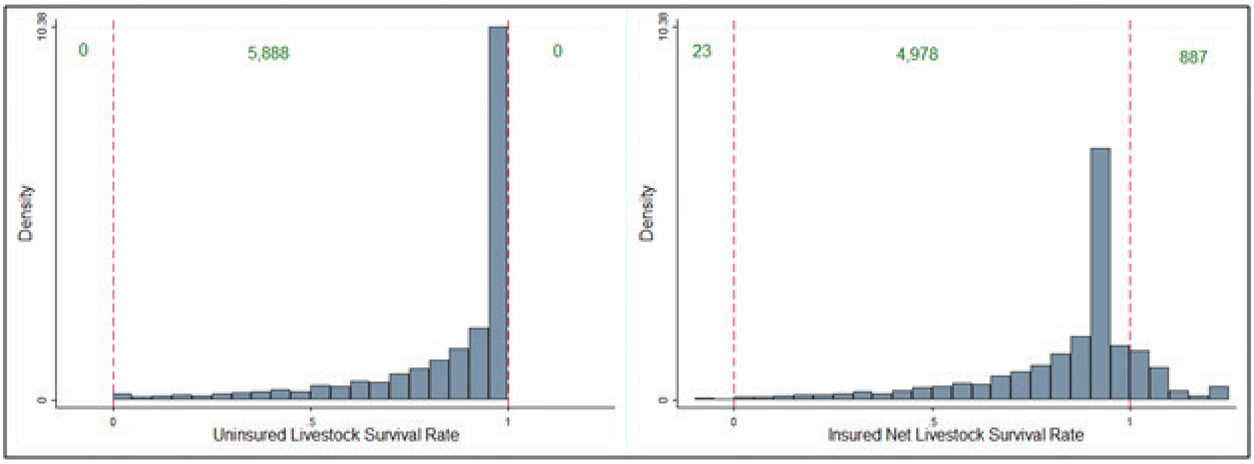
Histograms of the reported livestock survival rates and simulated net survival rates—the survival rate less the loaded and unsubsidized premium plus indemnity payments—illustrate the impact of IBLI coverage and give insight into the distribution of basis risk (Figure 1).

IBLI coverage clearly changes the domain, expected value, and shape of the distribution of outcomes. The average net impact of full insurance on the eight season within-household distribution of outcomes is to improve skewness at the cost of reducing expected outcomes (due to the premium) and increasing variance (due to excessive indemnity payments). Put more simply, IBLI reduces downside risk exposure but at a cost of not only the premium, but also of a wider range of possible outcomes because basis risk raises the possibility that one could pay a premium and (i) suffer losses but receive no indemnity payment, or (ii) receive an indemnity payment without suffering losses.

1. Variations on this IBLI product are available outside the region examined in this paper. The indices used in each region are not identical due to variation in the needs and constraints of each region.

2. The IBLI household survey data are publically available at https://livestockinsurance.wordpress.com/publications/.

Figure 1. Histograms of livestock survival rate and net livestock survival rate with full insurance.



Notes: Counts of the numbers of observations less than zero, between zero and one, and greater than one appear in green at the top of each figure.

Looking only at events during which there were large covariate shocks—the events IBLI is intended to provide protection from—we find that IBLI coverage successfully provides protection from 63% of the covariate risk but that households continue to face about 69% of their original risk because of the large idiosyncratic component, even during drought seasons. These findings suggest that there is room for improving the IBLI index, but that even with a perfect index, households will always face a substantial amount of uninsured idiosyncratic risk. But those statistics alone cannot tell us if IBLI is providing insurance coverage or access to a lottery for the majority of households.

To address this question, we modelled the benefits to prospective purchasers with and without IBLI coverage.[3] Consistent with the product during this research period, we maintained two contract premium regions – Upper Marsabit (Maikona and North Horr) and Lower Marsabit (Central, Laisamis, Loiyangalani) – which were then used to estimate and include the cost of premium payments in the calculations.

At the subsidized rate, which brings premiums below their actuarially fair rate, households might benefit from IBLI even if it does not reduce risk since, over time, they expect to receive more in indemnity payments than they pay in premiums. At the commercially loaded premium rate, risk averse households will only prefer IBLI coverage if it offers insurance coverage (i.e. reduces downside risk) rather than a gamble. We find that most—but not all—risk averse households enjoy net benefits from purchasing IBLI, even at unsubsidized rates (Table 1).

Table 1. The benefits of IBLI coverage

	Subsidized rate[1]		Commercial rate[2]	
	Lower	Upper	Lower	Upper
Proportion of households better off with IBLI than without	0.998	0.939	0.560	0.605

Notes: 1 During the period of this research, the annual subsidized rates are Lower Marsabit=3.325% and Upper Marsabit=5.5%. 2 The annual commercial premium rates are Lower Marsabit=10.0%, and Upper Marsabit=10.7%.

3. More specifically, we modelled household expected utility defined over the natural logarithm of livestock holdings, assuming constant relative risk aversion and a unit coefficient of risk aversion. For technical details, please consult the underlying paper.

Conclusions

Our analysis supports the commonly held, but rarely examined, belief that index insurance suffers from considerable basis risk. But we also found that IBLI nonetheless offers significant benefits to most households, even at commercially loaded premium levels, because it provides indemnity payments during critical periods of high livestock mortality. For that majority, IBLI operates as advertised, offering an insurance product against large drought shocks. But any index insurance product necessarily offers incomplete coverage. The community promoting these innovations might take greater care to ensure that they are indeed filling missing markets for insurance, not for lottery tickets.

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Data used in this paper is publically available at https://livestockinsurance.wordpress.com/publications/

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Page 1: ILRI/Riccardo Gangale
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