



Compound-risk aversion, ambiguity and the willingness to pay for microinsurance[☆]



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ABSTRACT

Index insurance – in which payments are based on an index correlated with, but not identical to, individual losses – has been faced with an unexpectedly low uptake, despite its promise as a tool for poverty alleviation. This paper offers new insights into the behavioral impediments to the uptake of index insurance. We start from the observation that an index insurance contract appears to the farmer as a compound lottery, with uncertainty about individual production outcomes, as well as about the validity of the index as a reflection of individual losses. Adopting the smooth model of ambiguity aversion to this insurance problem, we show that in theory this compound lottery structure per se will dampen the demand for index insurance. Using framed field experiments with cotton farmers in Southern Mali, we elicited the coefficients of risk aversion and compound-risk aversion. The experimental results find that almost 60% of farmers are compound-risk averse, and that the distribution of compound-risk aversion is such that it would nearly cut in half the potential demand for the standard index insurance contracts. Our results highlight the importance of designing contracts with minimal basis risk under compound-risk aversion. Such a reduction in basis risk would not only enhance the value and productivity impacts of index insurance, but would also assure that the contracts are purchased and have their anticipated impacts.

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1. Introduction

Behavioral economics has flourished over the past 30 years, providing compelling evidence that individuals systematically deviate from the predictions of classical models of rational economic choice. Despite their seemingly rich implications for the design of interventions and policies (Datta and Mullainathan, 2014), policy reliance on these behavioral insights has been modest, especially in the rapidly expanding area of microinsurance. Drawing on the related literatures of ambiguity and compound-risk aversion, and using parameter values estimated from framed field experiments in Mali, this paper offers

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new insights regarding behavioral factors that limit willingness to pay for microinsurance contracts. These insights suggest that contract designs that limit the probability that a contract fails to pay in the event of loss (or limit what is called “basis risk” in the context of agricultural microinsurance) will have unexpectedly large impacts on willingness to pay for microinsurance. By increasing insurance uptake, basis risk-reducing contracts would in turn be expected to have greater impacts on poor and rural populations in Africa and elsewhere in the developing world.

Uninsured risk impoverishes people and oftentimes keeps them poor by leading to suboptimal decision-making and forgone income (Alderman and Paxson, 1992; Carter et al., 2007). Formal insurance contracts would seem to have a promising role to play in risk-prone regions of the developing world. However, conventional individual indemnity insurance contracts are burdened by moral hazard and adverse selection problems that seem to guarantee their failure in rural regions of the developing world, where costs of verification are high and sums insured relatively small (see Hazell and Valdes, 1985). In contrast, index insurance contracts – in which payments are based on an easily verifiable index correlated with, but not identical to, individual losses¹ – appear as a promising solution to the long-standing problems of costly, uninsured risk. Even though the insurance they offer is partial and does not cover all risks and sometimes fail to pay even when a loss occurs, index insurance has most frequently been offered to protect against agricultural risks.

Much of the work on index insurance adopts an implicit expected utility perspective that although index insurance coverage is partial, some (actuarially fair) insurance is always better than no insurance. From this perspective, index contracts that offer even partial insurance will be demanded and have their expected impacts on improving the well-being of risk-exposed households. In this paper, we argue that this expected utility perspective may systematically overstate the desirability of index insurance and its expected impacts.²

We begin our analysis by looking at index insurance from the perspective of an individual producer facing the decision to purchase an insurance contract. Under index insurance, two random variables, or a compound lottery, confront the individual. The individual must first consider the likelihood that the insurance index will accurately reflect any losses he or she might experience. This additional lottery results from basis risk, or the imperfect correlation of the index with individual production outcomes. Of course, the individual then also must consider the probability that he or she will experience a loss. If the individual satisfies the Reduction of Compound Lotteries Axiom of expected utility theory, she or he would reduce this compound lottery structure to its corresponding simple lottery structure and insurance valuation will not be influenced by the compound lottery structure per se. However, there is ample behavioral evidence that this axiom is in reality violated by large numbers of people (see Budescu and Fischer, 2001 for example).

This paper examines the valuation of microinsurance when this axiom is violated, specifically focussing on the interrelated concepts of ambiguity and compound-risk aversion. Ambiguity aversion was first demonstrated by Ellsberg (1961), who showed that individuals react much more cautiously when choosing among ambiguous lotteries (with unknown probabilities) than when choosing among lotteries with known probabilities. While contract failure and other probabilities under index insurance are knowable in principal, individuals who cannot reduce a compound lottery to a single lottery are faced with unknown final probabilities as in the Ellsberg experiment. Halevy (2007) corroborates this intuition by experimentally establishing a relationship between ambiguity aversion and compound-risk aversion, showing that those who are ambiguity averse are also compound-risk averse.

To explore the implications of these ideas for insurance demand, we employ the smooth model of ambiguity aversion developed by Klibanoff et al. (2005). Following Maccheroni et al. (2013), we derive a compound-risk premium that can be attached to an index insurance contract. Using this premium, we in turn derive an expression for the willingness to pay (WTP) for index insurance. We define this WTP as the maximum amount of money that a farmer would pay while being indifferent between buying index insurance and having no insurance. We then show how this WTP measure varies with compound-risk aversion, risk aversion and contract failure or basis risk probability. Compound-risk aversion decreases WTP for index insurance relative to what it would be if individuals had the same degree of risk aversion but were compound-risk neutral. In addition, as basis risk increases, WTP for actuarially unfair index insurance declines for all individuals, but the decline is steeper under compound-risk aversion than it is under compound-risk neutrality.

While these theoretical results are interesting, the perhaps more important question is whether compound-risk aversion is sufficiently common and large to influence the aggregate uptake of agricultural microinsurance. To explore this empirical question, we implemented framed field experiments with cotton farmers in Southern Mali. We first used a fail-safe agricultural insurance experiment to elicit coefficients of simple risk aversion. Farmers were then introduced to an index insurance experiment in which there was a 20% probability that the insurance would not pay in the event of a loss. Finally, we solicited farmers' willingness to pay to eliminate this basis risk or contractual failure probability. While a compound-risk neutral individual would be willing to pay some amount to eliminate basis risk, we use participants' “excess” willingness to pay to eliminate basis risk as a way to gauge compound-risk aversion.

These experiments reveal that 57% of the participating farmers are compound-risk averse to varying degrees. For the more common forms of rainfall-based index insurance (which may fail to protect farmers against half of all loss events), the

¹ Examples of insurance indexes include average production levels in a locality, or rainfall levels. For further discussion on the logic of agricultural index insurance, see the discussion in Carter (2013).

² The insights in this paper apply to conventional indemnity insurance contracts, which typically also offer probabilistic protection and are prone to failure. For a developing county agricultural example, see the Carter et al., 2014 analysis of a conventional insurance contract in Ecuador.

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