Helping potential market participants understand index insurance: challenges and strategies

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There is reason to believe that index insurance could stimulate rural development. For insurance markets to function well and be sustainable, however, it is important that farmers understand how they operate well enough to be able to make informed decisions about whether or not to purchase insurance, and to trust that choice even if it seems, *ex post*, to have been a waste of money. Concerns about a lack of understanding go in two directions. The first is that farmers will forego the choice to purchase insurance, and will fail to realize the benefits that it offers. The second is that farmers will purchase insurance that is not right for them, and thus be harmed by having done so.

1 Background

Whether or not farmers purchase insurance is contingent on a number of factors. As rational actors in the strict economic sense, they will purchase it if it increases their expected utility or welfare, which depends on its net average cost to them, the likelihood and extent to which it shields them from losses, and their personal level of risk aversion. As social actors, they will purchase insurance based on whether they trust the people who are selling it, and whether they observe other members in their community doing the same. As real people, their decision is probably predicated on a number of factors, most importantly their personal prior experience with insurance.

The economic calculus requires some ability to work with probabilities. There is an extensive literature, based largely on experimental methods, demonstrating that individuals display certain biases in the appraisal of likelihood (Kahneman and Tversky, 1979; Tversky and Kahneman, 1974). Another set of studies have shown that people's probability perceptions, and how those perceptions influence their judgments, depends on whether it is born out of their own experience, or from information that others have given them, and in the latter case, the vividness of the explanation (Patt, 2007; Weber, 2006). This could be quite relevant in the context of index insurance, because it would suggest that prior experience purchasing insurance, being exposed to its often complicated payout likelihoods, could work differently than a verbal explanation. Studies of people's willingness to pay for flood insurance in developed countries have yielded results consistent with the presence of behavioral biases (Johnson et al., 1993; Kunreuther, 1996).

A special concern has arisen with respect to subsistence farmers: that they lack the educational background and mathematical skills to be able understand and use probabilistic information. Research has demonstrated this concern to be nuanced, but by and large unfounded. First, subsistence farmers perform qualitatively the same as westerners on tests of probability understanding, and their quantitative performance improves when decisions are framed not in the abstract but in familiar terms, such as what crops to plant given different probabilities of different amounts of rain (Patt, 2001). Second, farmers who receive probabilistic information coupled to specific advice are significantly more likely to trust and use the advice, compared to farmers who receive the advice alone (Patt et al., 2005).

Relevant for the social calculus, there is also a growing literature on trust, and the ways to enhance or destroy it both in different cultural contexts (Bohnet and Zeckhauser, 2004; Herrmann et al., 2008), and among subsistence farmers in particular. Much of the latter comes out of work on seasonal forecast communication and responding to climate variability. In the state of Ceará in northeast Brazil, for example, there was a highly successful programme to communicate forecasts, coupled with distributing lower yielding but drought tolerant seeds in years where rainfall was anticipated to be slight. The programme enjoyed high levels of trust, until one year when farmers planted the drought tolerant seeds, rainfall turned out to be good, and harvests were lower than they otherwise would have been (Glantz, 2000; Lemos et al., 2000). A similar story emerged in Zimbabwe, but here the result was more nuanced: it appeared that who farmers had received the forecast from influenced the degree to which trust fell (Patt et al., 2007). In a set of comparative case studies, theoretically informed by a wider literature on knowledge brokering institutions, researchers have observed that organizations with identifiable accountability to farmers were more trusted when communicating forecasts, especially after perceived forecast error (Cash et al., 2006). A related study observed a similar increase in trust in the context of a controlled experiment, set up as a decision-making game (Patt et al., 2006).

2 Case studies

The recognition that many people may not only have difficulties understanding index insurance, but also that their decisions about whether to purchase it or not may be sensitive to how the concept is presented to them, has led a number of researchers to explore ways of improving that presentation. Much of this has been built around the use of role-playing games, both as a research tool, and as a way of giving farmers an experience similar to that of actually buying insurance over several years.

2.1 Worksheets and workshops in Malawi and Ethiopia

Nicole Peterson and other researchers from the IRI worked with farmers in Malawi and Ethiopia, as part of efforts to introduce pilot index insurance schemes. In Malawi, the researchers had the task, during the second year of the pilot, of ensuring that farmers understood the index insurance contracts. Importantly, banks and insurance companies wanted to avoid any misunderstandings about payouts in the coming year. The researchers developed a worksheet that included the key characteristics of the previous year's contract, including the amount of rainfall needed for a payout, and what the payout would be under different amounts of rainfall. They also presented the information to farmers graphically, and included data on what payouts would have been with this contract in previous years. They held several workshops with local farmers, and asked them to calculate, using the graphs, how much of a payout they would receive under different amounts of rainfall. The participants in these workshops had very few problems understanding and using the worksheet tool, and even made suggestions on how to change the slope of the graph to represent their losses better.

Throughout these workshops and in a separate set of focus groups and surveys in Ethiopia, several important issues arose for these types of insurance projects. First of all, the relationships with farmer organizations or development groups were crucial for establishing and maintaining these programs, for reasons of trust, experience with the communities, and the connections to organizational networks. In some cases, it seems that agriculturalists are interested in these projects for the sole reason of maintaining these important relationships. Second, these communities have often developed risk-mitigating strategies, such as cattle or communal sharing of unforeseen expenses. While insurance programs may be useful supplements to these systems, there is also the possibility that they will replace these local strategies, leaving participants unprepared to deal with uninsured risks. Third, banks, insurers,

and others often underestimate the ability of the farmers to articulate their needs and preferences, limiting the potential to create programs that provide useful benefits. Insurance programs thus have the potential to meet the needs of various participants, but should be considered one strategy among others for mitigating climactic risks. Altogether, the interaction between researchers and farmers suggested that farmers' ideas about relationships, risk, and expected benefits were crucial to the success of the pilot schemes. The workshops also provided the researchers with insights into how particular concepts might be communicated, such as the rain gauge and contract-specific time periods. These insights have been collected in a training manual for program representatives.

2.2 An abstract game in Brazil

Maria Velez and other researchers from Columbia University's Center for Research on Environmental Decisions (CRED) conducted decision-making experiments with cash payments to test individual understanding and behavior facing an offer of basic index insurance, in Ceará, Brazil, The region and state are characterized by low rainfall but high rainfall variance, and is where seasonal climate forecast credibility had fallen so dramatically many years before. Uncertainty is a central feature of agriculture decisions. A total of 266 subjects participated, from both the urban and rural area.

The games to this point have framed the probabilistic decision in the abstract, rather than drawing specific reference to rainfall and crop yields. Participants played a game in which they won a prize, depending on a two stage random process. The first stage was to assign them randomly to one of two boxes (A or B), while the second stage was to draw a random ball from the box they had been assigned. The balls were either red or blue—Box A always had more red balls than blue, while Box B had more blue balls—and blue balls provided a higher prize. Participants' only decision was whether to pay a small amount of money for a contract, which would in turn pay them a larger amount of money back if Box A (the one with more bad red balls) was assigned to them in the first stage. Individuals decided whether to buy or not for each of 20 contract prices, in each of several scenarios featuring different probabilities of being assigned Box A and different distribution of balls within each box. The analogy to index insurance is straightforward. Whether one is assigned Box A or B is equivalent to the value of the index. Whether one draws a blue or red ball is equivalent to having a good yield or bad. Basis risk is the risk of drawing a red ball from Box B, the one with more blue ones.

At this point there are preliminary results based on exit surveys, but not yet hard analysis of the game playing strategies. The surveys demonstrate the challenges of explaining and understanding experiments of this type with this kind of abstract framing. Without a connection to a real context, the rules seemed arbitrary, and participants had difficulty understanding the difference between different elements of the setting. "Luck" was a common answer when explaining individual decisions, and about 20% of participants in each session switched decisions back and forth between prices (which would not appear to be rational although some explained this behavior as indifference at low prices). Moreover, price levels appeared to be more important determinants of decisions than information about the probability of being assigned Box A, or the composition of the balls in the two boxes. The upcoming analysis will, most likely, back up these insights with statistical significance.

2.3 Insurance games in Peru, Ethiopia, and Malawi

Finally, several researchers have conducted games very similar to the ones in Brazil, except that the two-stage random process was framed specifically in terms of community rainfall and individual luck, and the decision was framed specifically in terms of whether to purchase index insurance.

Michael Carter and his research collaborators[1] have devised and implemented two index insurance simulation games: one for cotton farmers in Peru and a second for pastoralists in Kenya. [2] Both games were devised after the design and pricing of index insurance contracts for each location. The contract design work included estimation of the probability distribution of both the insurance index and of the residual basis risk farmers would face. This information allowed the games to be framed in terms most familiar to the participants. The Peruvian cotton game, which was designed to mimic an area based yield contract that is now under sale in Peru, was cast in terms of the land areas, units of measure and cost structures that constitute the daily lives of farmers in this region. Indeed, farmers were at ease discussing (and in some cases disputing) the accuracy of the information used in the game.

The researchers' expectation is that farmers are more prone to take such a precisely framed game seriously, as an analogue to their reality, rather than a mere 'game.' In addition, researchers were able to use such a precisely framed game to explore farmer preferences over contractual options (e.g., contract strike points) as well as to obtain information on sensitivity to price (farmers played the game at both actuarially fair prices as well as prices marked up by standard loading factors). In the case of Peru, the final contract design was based on farmer feedback obtained during early versions of the game. The final game, based on the market price and other characteristics of the real contract, was played with nearly 450 cotton farmers. Just under two thirds of those farmers 'purchased' the insurance in the game. Research is currently underway to determine if these game findings accurately predict real world transactions.

A second critical design issue in the Peru and Kenya insurance games concerns the how to capture intertemporal incentives in the games. For example, Peruvian cotton farmers risk losing their land and future credit market access if they are unable to repay loans in any given year. A potentially important advantage of insurance is not only that it insulates current income from shocks, but also that it protects individuals against these inter-temporal or future period penalties. In the Peru game, farmer played a sequence of simulated crop years. If any year they were unable to repay a loan based on random outcomes of the game, then in all future game years they were excluded from the credit market and could only employ a low return strategy. In addition, farmers were paid the value of their land at the end of the game. Farmers who had defaulted during the game were given a lower per-hectare payment for their land. Participant farmers appeared to find these penalties sensible and they definitely appeared to shape play within the game.

In Kenya, the participant pastoral population is much less commercially oriented than the Peruvian cotton farmers and production credit is almost unknown. However, research in that region suggests that pastoralists are subject to non-linear, poverty traps dynamics. Any pastoralist who falls below a critical minimum herd size threshold is likely to collapse to a low level, poverty trap equilibrium. Such poverty traps thresholds potentially give a huge advantage to insurance that protects individuals from falling below that threshold.

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[1] Carter's work in Peru is joint with Stephen Boucher (University of California Davis), Carolina Trivellis (Instituto de Estudios Peruanos and graduate students Francisco Galarza (Wisconsin) and Conner Mullally (Davis). The Kenya project is joint with John McPeak (Syracuse University), Chris Barrett (Cornell University), Andrew Mude (international Livestock Research Institute) and graduate student Sommarat Chantarat (Cornell).

[2] Additional details on the games can be found in *BASIS Brief* no. 2008-06 "Insuring the Never-before Insured: Simulation Games to Explain Index Insurance and Determine Demand" (http://www.basis.wisc.edu/publications_ama/ama_publications.html)

To capture these intertemporal incentives for insurance, the game was designed such that expected net heard growth was positive above the threshold and negative below the threshold. While potentially complicated to implement in the field, a simple fixed cost mechanism was used to implement the non-linear dynamics. Each individual in the game maintained a stock of chips representing their herd in tropical livestock units (TLU). At the beginning of each year of the game, each individual had to pay 0.5 TLUs to cover necessary cash expenses for the family. A growth rate was then determined for each person (based on a common draw for a covariant shock and an individual draw for an idiosyncratic shock). With an expected herd growth rate of 7% per-annum, any herd below about 7 TLUs would actually shrink in size following payment of the 0.5 TLU fixed cost. Preliminary tests of the game (with the insurance priced at an actuarially fair premium) revealed that nearly 100% of the pastoralists purchasing insurance with most individuals buying protection for their entire herd. While still under development, the game is being used to explore the sensitivity of demand to herd size (wealthier herders seem to buy slightly less coverage) and other contract parameters. The actual insurance contract is currently slated to be sold in advance of the short rains in mid-2009.

Pablo Suarez and Anthony Patt, consultants working for the World Food Programme, have played similar games with farmers in Ethiopia and Malawi. Like Carter, they framed the game in terms of rainfall, yields, and insurance, but the probabilities and prices were not tied to local conditions. After playing the game, the participants filled out a survey, structured as a series of true/false questions, which tested whether they understood some of the basic concepts of insurance. Another group of farmers (i.e. a control group, selected randomly from the entire pool of participants), filled out the same survey, but instead of having first played an insurance game, a facilitator explained to them all of the basic ideas about index insurance. Thus the experiment yielded two sets of data. The first was how farmers played the game, and the second was the relative effects of game playing and verbal explanation on comprehension. The researchers have not yet analyzed the data from the game itself, although anecdotal evidence suggests that here, as in Peru, farmers playing a game framed explicitly in terms of rainfall, yields, and insurance seemed to make reasonable decisions. The researchers have, however, analyzed the survey, and these results are more pessimistic. First, the results suggest that participants had very little understanding of the basic concepts underlying index insurance, and were essentially guessing in order to answer most of the survey questions. Second, compared to the control group, game participants did perform slightly better on some of the survey question. But the differences were slight, and across all survey questions, even with 278 survey takers, statistically insignificant.

3 Conclusion

There is a substantially literature grounded in a number of disciplines that offer reasons to worry that farmers will make poor insurance decisions, and also reasons to believe that gaining practical experience could help. A number of studies have attempted to test these hypotheses. Survey results from two studies support the first of the two: farmers do poorly understanding the probability problems present in making economic decisions about insurance. There has not yet been analysis of data relevant to the second, but preliminary evidence suggests that farmers playing role-playing games do make good decisions in the context of the game, and that this could translate into good decision-making in actual insurance markets. If the upcoming statistical analysis supports the second of these findings, then there is potentially a contradiction. The resolution of the contradiction may indeed be that decision-making is not explicitly or exclusively rational, but rather depends on a combination of factors, at both the conscious and subconscious levels. In this case, games may help people to make good decisions, even if they themselves do not know the reasons why.

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