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ORIGINAL ARTICLE

Making index insurance attractive to farmers

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Abstract There are several factors that influence whether people will want to participate in index insurance programs. A number of these influence their attractiveness on economic grounds, including both the size and timing of the premium and potential payouts, and the degree of risk aversion of the potential customers. Other factors make programs attractive for reasons that are not economic, but no less valid. These have to do with the trust that people have in the insurance product and the organizations involved in selling and managing it. Indeed, data from India, Africa, and South America show that these factors may be more important than the economic ones in influencing demand. Index insurance pilot projects, in order to estimate demand for alternative products, have typically involved a great deal of interaction with potential customers. It is important to recognize that such interaction is crucial not just as a research tool, but also as a means to build understanding and trust in the products. When scaling up from isolated pilots to operational programs, it is vital to recognize this trust building function by replicating participation efforts in every community. In this paper, we examine the role of field games in establishing and building trust in three important aspects of these projects for participants: trust in the insurance product, trust in the participating organizations, and trust in their own ability to make good

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decisions. While games have previously been used as a way to gauge interest in the product and to identify design features, we argue that these games are also valuable tools for constructing these kinds of trust.

Keywords Index insurance · Smallholder farmers · Role-playing games · Climate variability · Climate adaptation

1 Introduction

One of the major challenges facing both farmers and whole economies in developing countries is interannual rainfall variability. In sub-Saharan Africa, for example, 95% of the crop-land is devoted to rain-fed agriculture, and over 90% of the population depends on rain-fed agriculture for their basic food requirements (FAO 2000); 200 million people go hungry in years of poor rainfall (IRI 2005). Climate variability is an impediment to human development, and to progress towards the Millennium Development Goals (MDGs). Given projections that climate variability—in terms of both extreme events and seasonal anomalies—is likely to increase, coping with climate variability is also a critical concern for climate change adaptation (Boko et al. 2007; Washington et al. 2006).

There are a number of coping strategies that participants in traditional farming systems employ to cope with climate variability (Scoones et al. 1996), some relying on risk spreading (Roncoli et al. 2001), and others relying on the use of both traditional and scientifically derived seasonal climate forecasts (Klopper et al. 2006; Patt et al. 2007). These coping strategies, however, are often challenged in years of particularly poor rainfall (White et al. 2005), when entire communities are hit by a common event that makes it impossible to provide relief through traditional safety nets, and often challenges international relief efforts (Linnerooth-Bayer et al. 2005). For this reason, there has been growing interest within the development community to explore the possibility of developing using microinsurance—insurance tailored to the needs of the poor—to cover the potential losses to small-holder farmers associated with climate variability (Churchill 2006; Osgood and Warren 2007).

There is now reason to believe that crop insurance, and index insurance in particular, could stimulate smallholder rural development in a way that allows farmers better to adapt to climate change (Dercon et al. 2008; Leftley and Mapfumo 2006). At a most basic level, such insurance could draw on outside capital reserves to provide relief (Hochrainer et al. 2009; Meze-Hausken et al. 2009). Such insurance can also, however, provide benefits that allow farmers to improve their average harvests, such as by guaranteeing the repayment of loans, which in turn would allow farmers to plant higher yielding crop varieties (Leftley and Mapfumo 2006; Osgood and Warren 2007). In India, such insurance schemes have become established (Manuamorn 2007), while in Africa and Latin America they are only now being introduced (World Bank 2005). One particular form of insurance, index-based insurance, has received a great deal of attention (Alderman and Haque 2007). Under and index-insurance scheme, farmers receive a payout that is tied not to their actual yields, but to the timing and quantity of rainfall as measured at a local monitoring station. This reduces transaction costs significantly, and yet it also introduces the problem of basis risk: when a farmer suffers a loss but receives no insurance payout (Barnett and Mahul 2007).

But insurance is also costly, and particular insurance contracts are inappropriate for many farmers (Barnett and Mahul 2007). To make sure that index insurance is most attractive to individual farmers, it is important both to tailor the insurance contracts to

match their precise needs (Cohen and Sebstad 2006; Skees et al. 2007), and to make sure that farmers understand these contracts well enough to make an informed choice (McCord 2001). Neither task is trivial.

Abundant evidence from the field suggests that farmers in developing countries have a difficult time understanding index insurance, at least when they first encounter it (Dercon et al. 2008). Anecdotal evidence includes stories of farmers who are upset if they do not receive their premiums back at the end of the year, or if they receive no payments for a failed crop because the rainfall index performed well (Suarez et al. 2007). Helping farmers understand index insurance will not only avoid situations like these—which can destroy confidence in the product—but will also improve the chances that a given farmer purchases index insurance that makes sense for her, and does not purchase insurance that fails to meet her needs. Designing an insurance contract that meets farmers' needs, and is attractive to them, is also challenging. From an economic perspective, farmers purchase insurance 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 (Churchill 2006). From a more social perspective, 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 (Suarez et al. 2007). As real people, their decision is probably predicated on a number of factors, most importantly their personal prior experience with insurance. Designing a product that well informed farmers will want to buy means responding to all of these factors.

There is a growing literature on the factors that influence whether insurance makes sense in developing countries, and how to make such markets work in practice and contribute to development (Churchill 2006). Most of these studies are in the area of health insurance in developing countries, and very few examine issues associated with crop insurance in particular (Dercon et al. 2008). In this paper, we examine these issues with respect to index-based crop insurance. In particular, we differentiate between those factors that matter for economic reasons, and for reasons having to do with social and cultural factors. We then examine several case studies and pilot projects from Africa, India, and Latin America to explore the relative effects of economic and non-economic factors at influencing demand. From these studies and the underlying theory, we suggest a number of ways to increase the attractiveness of index insurance. We conclude by offering lessons for how to scale up pilot projects into large-scale programmes. The most important lesson, we suggest, is to continue to emphasize close and creative communication among the many participants in the insurance market.

2 Models of demand for index insurance

In this section, we review theory from a number of disciplines that can contribute to a model of demand for index insurance. The discipline that has examined insurance most thoroughly is economics, and we devote the first part to this body of theory. A number of other disciplines, including psychology, anthropology, and sociology, all offer somewhat different perspectives. We group these together under the heading of "non-economic models," for lack of a better single term.

2.1 Economic models

The economic model of the individual posits that people make decisions in order to maximize their utility, which is the total amount of enjoyment, comfort, and happiness that

they derive from a set of experiences. While it is not possible to observe utility directly, a set of axioms and observations has allowed economists to describe some of its basic features. First, greater consumption, or wealth, leads to more utility. Second, as people consume more, they derive less additional utility from each additional amount of consumption. For example, owning one bicycle is great, but owning two bicycles is only a little bit better. These two principles suggest a utility function as seen in Fig. 1a, which is curved. Exactly how much it is curved—especially with respect to the quantity of any single type of consumption—depends very much on the individual; some people enjoy the second bicycle almost as much as the first, while others find it nearly worthless.

That the utility function is curved gives rise to risk aversion. Imagine that you are a farmer with fields that can produce 10 tons of maize, which when combined with your other income gives you a particular level of consumption. There is a chance—in this case imagine it to be 50%—that inadequate rainfall will destroy your entire crop, causing a loss of total consumption and a lower level of utility. As seen in Fig. 1b, the curvature of the utility function ensures that utility of the average of your harvests is greater than the average of the two levels of utility that you will actually experience. You are risk averse

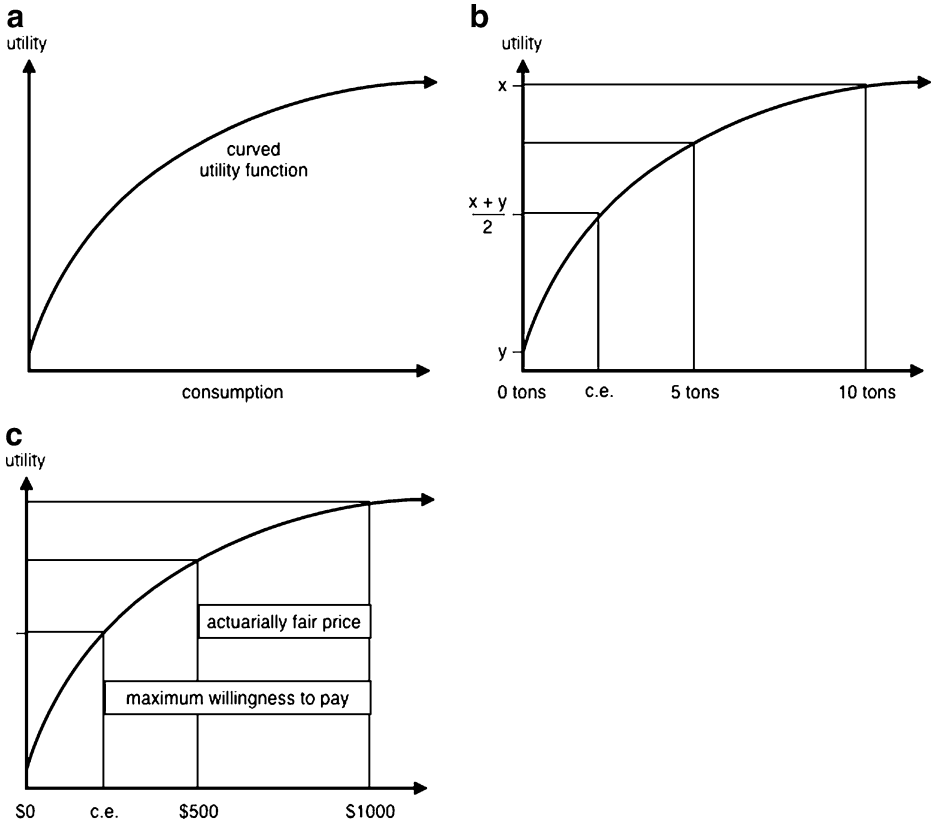

Fig. 1 Economic theory of insurance. Figure 1**a** shows the curved utility function, a result of decreasing marginal utility. Figure 1**b** shows how this can lead to risk aversion, and a certainty equivalent (c.e.) that is substantially less than the average value of a risky outcome. Figure 1**c** shows how this can give rise to a functioning insurance market, since people's maximum willingness to pay for insurance may be sufficiently higher than the actuarially fair price to cover the insurance company's costs associated with offering it

because you would prefer to have 5 tons with certainty than to face the constant gamble between 0 and 10 tons. There is some quantity of maize that is your certainty equivalent (c.e.), which is less than 5 tons. There is reason to believe that poorer people—who might actually starve if they do not harvest any maize—are more risk averse and have lower certainty equivalents.

Figure 1c illustrates how this can give rise to an insurance market. Assume that each ton of maize is worth $100, so that in any given year you will either earn $0 or $1,000, depending on the rainfall. Imagine an insurance contract that will pay you $1,000 if your harvest fails. How much would you be willing to pay for that? The actuarially fair price would be equal to your average loss, or $500. Because you are risk averse, however, you would be willing to pay more than that, up to the amount that guarantees you your certainty equivalent.

The challenge for an insurance company, therefore, is to design a contract where the premium falls below farmers' maximum willingness to pay, and also enough above the actuarially fair price to cover their transaction costs and satisfy their investors. In many cases, the willingness to pay may be less than the price the insurance company needs to charge in order to cover its expected payouts and transaction costs. In such cases, there is no market for insurance. Index insurance lowers transaction costs compared to indemnity insurance, but also introduces basis risk.

Several results from the field of behavioral economics suggest some important challenges in designing successful insurance markets. There is an extensive literature demonstrating that individuals display certain biases in the appraisal of likelihood (Camerer 2001; Kahneman and Tversky 1979; Tversky and Kahneman 1974). They have difficulty integrating probabilistic information into their decisions (Nisbett and Ross 1980; Tversky and Kahneman 1973), although they find it easier when probabilities are expressed non-statistically (Weber 1994), when given a causal interpretation (Tversky and Kahneman 1992), or when they can apply lessons from familiar domains (Nisbett et al. 1983) like guessing the sex of a child (Phillips and Orlove 2004). Finally, both probability perceptions and how those perceptions influence judgment depend on whether their knowledge comes from their own experience or from others (Weber 2006). In the former case, they are more affected by recent events than by those in the more distant past (Tversky and Kahneman 1973; Wänke et al. 1995), leading to the perverse result that people are most likely to purchase insurance directly after a loss (Johnson et al. 1993; Kunreuther 1996), rather than when it has been some time since they suffered one (and in areas where weather patterns are cyclical, such as through the result of El Niño, adverse weather is more likely to occur). In the latter case, people tend to behave as if the likelihood in question were in all cases closer to 50/50, e.g. they respond to a 10% likelihood as if it were 25%, and to an 80% likelihood as if it were 60% (Bruine de Bruin et al. 2000; Patt 2007). This could be especially important for index insurance: farmers may do reasonably well at estimating the chances of their crops failing, based on past experience, but find the task of estimating basis risk more difficult, for a lack of experience. In particular, because of the 50/50 bias, they may react to basis risk as though it were almost as large as the underlying risk against which they are insuring.

Another important behavioral finding is that people have a difficult time saving money and other commodities, as a result of present-biased discounting (Frederick et al. 2002; Laibson et al. 2004; Loewenstein and Elster 1992). On the one hand this suggests an important reason why insurance may be so important, namely that people are unlikely adequately to self insure; they will find it difficult to accumulate the assets necessary to help them weather one, or worse yet two, seasons of poor rainfall. Analogous to special

retirement plans where it is difficult to access saved money, insurance can generate net gains in utility by overcoming this difficulty (Cropper et al. 1994; Laibson 1997). But it also suggests that people may not have enough liquidity even to pay an insurance premium.

Making insurance marketable can thus be challenging. First, it is often hard to estimate the exact distribution of losses, both in terms of quantities of crop, and corresponding likelihoods. Second, it is hard to estimate people's actual level of risk aversion, and hence their maximum actual willingness to pay. Indeed, their willingness to pay is constantly changing, as other events in their lives make them more or less able to take on risk in this area. The behavioral findings make it even harder, since they explain why many people will not purchase insurance when it would seem to be in their interests to do so, while others may purchase it even when it is a bad investment. Given these challenges, perhaps the simplest and clearest way to improve the attractiveness of insurance, while increasing the likelihood that it is in their interests to do so, is to reduce the transaction costs associated with its delivery. Ideally, the premium should be as close as possible to the expected payouts. Another important way to increase the likelihood that people will be able to purchase insurance is to offer it when people are most liquid, such as when they take out a loan.

2.2 Non-economic models

Economic models suggest that the decision of whether to purchase index insurance depends on the perceived probability distribution of outcomes the farmer faces with and without insurance, and the farmer's level of risk aversion with respect to potential crop losses. Other social and behavioral sciences describe the process of choice quite differently. We present a small number of such models that are particularly relevant for insurance.

2.2.1 Bounded rationality

A body of theory known as *bounded rationality* describes the choice process as one of "satisficing," rather than optimizing (Simon 1956, 1991). With limited time and resources to make a decision, people do not look for the option that is optimal, but rather settle on the first one that adequately meets their needs. To judge whether a particular option is satisfactory, they rely on a number of mental shortcuts—sometimes conscious but more often subconscious in nature—known as heuristics. Some of these, such as those used to estimate likelihood that we described above, also play a role in behavioral economic models, but the theory of bounded rationality suggests that heuristics are not just tools to help identify the optimal course of action, but can also be the way to arrive at decisions in the first place. There is evidence that the "adaptive toolbox" of heuristics leads to better decisions than attempts to apply more formal decision analysis under situations of limited time and information (Gigerenzer 2000; Gigerenzer and Selten 2001).

Bounded rationality could be important for index insurance in two ways. The first is that people generally do not make changes in their lives unless they view the status quo as unsatisfactory; when they do make a change, most of all it has to fix a perceived problem, while being something they can live with in other respects (Munroe and Sugden 2003; Samuelson and Zeckhauser 1988). For example, people may not really care how high an insurance premium is, as long as it is not unacceptably high. A critical empirical question suggested by bounded rationality is whether people will view the presence of basis risk as meaning that index insurance fails completely to fix the fundamental problem, namely the possibility of a large loss. A second implication derives from the use of heuristics to judge

acceptability, and the theory that people often start in a new decision domain with fairly crude or inappropriate heuristics, perhaps borrowed from other decision domains, and improve them over time (Nisbett et al. 1983; Payne et al. 1993). Since index insurance is new to most developing country farmers, there is reason to expect that their first decisions with respect to purchasing it could seem to be guided by nonsensical ideas, and only over time improve.

2.2.2 Models of trust

There is a great deal of evidence linking remembered, experienced, and anticipated emotions with the decision making process (Damasio 1995; Elster 1998; Peters et al. 2006). Emotions influence how people perceive and respond to risks (Covello 1990; Ditto et al. 2006). Among the most important emotions for decision-making are those arising out of the presence or absence of trust (Cook 2003). Research has focused on three kinds of trust: trust in other people, trust in other information and products, and trust in oneself.

To examine the conditions under which people trust others, experimental researchers often have used variants of a particular economic game involving two players. Player One receives a certain amount of money, such as $10. She can give any amount of this to Player Two. Any amount she gives is multiplied by a certain factor, such as 2. So if she gives $5, Player 2 actually receives $10. Player Two can then decide to give any of the amount he receives back to Player One. The total winnings are greatest when Player One gives the entire $10 to Player Two, but she needs to trust that she will receive a fair amount back, hopefully more than she had originally decided to give. Researchers have found that levels of trust correlate with cultural backgrounds (Greig and Bohnet 2005), with gender (Bohnet and Zeckhauser 2004), and with the exact structure of the game (Bohnet and Huck 2004); for example, making it possible for players to punish those who fail to play for the common good, can also make a big difference (Fehr and Gächter 2002; Herrmann et al. 2008). The message is that trust in other people is not a given, but responds to social factors, cues, and incentives.

Closely linked to trust in other people is trust in the information that one receives from other people. In the state of Ceará in northeast Brazil, for example, there was a highly successful programme to communicate seasonal forecasts, coupled with distributing lower yielding but drought tolerant seeds in years where rainfall was anticipated to be slight. Farmers were happy to participate, 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. Farmers lost trust in the information, and were unwilling to participate in subsequent years (Glantz 2000; Lemos et al. 2000). Again, however, how levels of trust respond to observed information quality can depend on the social context within which the information is offered (Argote et al. 2000; Darr and Kurtzberg 2000; Patt et al. 2006; Sniezek et al. 2004), and on the reputation of the person offering the information (Sniezek and Van Swol 2001). Using a case study comparison of seasonal climate forecasting systems, Cash et al. (2006) observed that organizations with identifiable accountability to farmers were more trusted when communicating seasonal climate forecasts, especially after perceived forecast error.

Finally, whether people will take new information and use it to make new decisions depends on whether people trust themselves, believing in their own personal ability to make successful changes (Prentice-Dunn and Rogers 1986). Many people do not. Grothmann and Reusswig (2006), studying whether people living in flood plains engaged in efforts to mitigate the effects of water damage, found the behavior to correlate close with expressed

feelings of self-efficacy, and these in turn to depend on the degree of empowerment in the community.

All three kinds of trust can matter a great deal for index insurance markets. People need to trust that the people they are paying to take on their risk will be around to hand out payouts; they need to trust the structure of the contract, and the rainfall index; and they need to believe that their decisions can positively influence their livelihoods. One of the ways that has been shown to increase all three kinds of trust is participation, and it is now an approach to communication used by many large agencies, such as the World Bank (Agrawal and Gibson 1999). At heart, participation is intended to involve the potential beneficiaries of the program in its design and implementation, with the hope that their input and assistance will both improve the project design and create greater support for the project within the target communities. While there are some important criticisms of the participatory model for promising greater inclusion and involvement than it delivers (Agrawal and Gupta 2005; Cleaver 1999), it is one of the few tools that encourages community involvement in development programs. Because participation increases the ability of participants to interact with analysts on the one hand, and to develop their own strategies for action on the other, it enhances farmers' trust in the other participants, in the programme, and in their own decisions to participate (Kasperson et al. 1995; Patt et al. 2005).

3 Experiences from recent field studies

There have been a number of recent attempts to identify the types of index insurance contracts that are most attractive to farmers, as well as ways to help farmers better understand how index insurance operates. These provide data that reflect on the validity of the underlying models. These field studies also suggest the importance of non-economic aspects of the program for participants, particularly the role of trust and information exchange, encouraging greater attention to contract design beyond economic utility and other similar factors.

3.1 The role of chance and pricing: an abstract game in Brazil

Researchers from Columbia University 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, leading to a decrease in confidence in seasonal climate forecasts, and to the centrality of uncertainty in agricultural decisions. The experiments consisted of participants playing a probabilistic game, which was the same in structure to an index insurance market, but not framed as such. Participants could win a prize, depending on a two stage random process. The first stage randomly assigned each participant to one of two boxes (A or B), while in the second stage each person drew a random ball from his or her assigned box. The balls were either red or blue, with blue balls giving a higher prize than red balls. Box A always had more red balls than blue, while Box B always had more blue balls. Participants had to decide whether to pay a small amount of money for a contract, which would give them a payout if Box A (the one with more bad red balls, and the lower chance of a good prize) was assigned to them in the first stage. Over multiple rounds of the game the price of the contract varied, as did the probabilities for each of the two stages of the game. 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 bad ball from the good box.

Surveys completed by participants at the end of the experiment indicate the challenges of explaining and understanding experiments of this type with this kind of abstract framing. Participants reported that the rules seemed arbitrary, and that they 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—whether or not they seemed to be affordable or not—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. Additional analyses are forthcoming, but the current results and inconsistencies in contract purchase decisions suggest that the decisions to buy a contract were not based on an expectation of economic outcome.

3.2 Trust in product and organizations: workshops and surveys in Malawi, Ethiopia, and India

While the previous game focused on abstractions of the economic choices available through the index product, another set of workshops and surveys focused on the role of communicative tools and organizations on insurance demand. Through these activities, researchers learned how trust enters into the project and how participation can strengthen this. Researchers from Columbia University, the International Institute for Applied Systems Analysis, and a group of funders including the World Bank, World Food Programme, and Oxfam worked with farmers in Ethiopia and Malawi, as part of efforts to introduce pilot index insurance schemes.

In Ethiopia, farmers and researchers worked together to establish the historical rainfall distribution for the area. Farmers were asked to use local materials (wood sticks) to indicate a "good" and "bad" rainfall distribution for specific crops, taking as examples two historical years. Participants in the focus groups arranged sticks of different length on the ground, to designate the amount of rainfall for each month of the cropping season in the two years. The resulting calendars were used by the team insurance experts to calculate the monthly weights in the rainfall index for crops in those areas. Results perfectly matched the agro-meterological patterns for those crops. As an example of participatory research (Pretty 1995), this experience shows potential for increasing interest in the project and assuring connections between the assumptions made about rainfall in the insurance contract and the experiences of farmers. In other cases, these elements have proven crucial for trust in the design process and implementation.

The Malawi pilot project involved an insurance contract that was a precondition for receiving a loan for farming inputs. 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 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.

Farmers in these workshops were able to use these worksheets to calculate insurance payouts under different rainfall conditions, suggesting that they understood the details of the contract and the way the contract was represented in the worksheet. In addition, farmers were able to communicate the details of the contract to other farmers using the worksheet, and used the worksheet to make design recommendations. This tool became a valuable means for both communicating aspects of the project and soliciting information from farmers about their preferences. Farmers stated that they now understood the project better and felt it provided a valuable means to decrease the risk of climate change. 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. The important insight from these workshops is that through participatory methods, farmers were able to learn how the insurance contract operated, and how to explain it accurately to others.

In addition, the Malawi workshops also provided important insights into the role of organizational relationships for the program. All farmers were members of the National Farmers Association of Malawi (NASFAM), and had received financial and technical assistance from the organization in past years. The role of NASFAM in the insurance pilot was to administer the insurance policy to groups of farmers, collecting premiums, disbursing loans, and collecting the harvested crops as loan repayment. Despite problems in the previous year of poor seed quality and lower-than-market prices paid for harvested crops, farmers showed a preference for continuing working with NASFAM on this project, recognizing the faultlessness of the organization in the first case, and their history of working well with farmers in the second.

This trust in the organization was verified through survey data collected after the workshops concluded. The survey asked farmers to state where they placed their greatest trust. As Fig. 2a shows, fifty percent of the survey respondents placed the greatest amount of trust in the farmer organization, compared to 25% in the lending institution, 13% in other farmers in the community, 11% in the insurance company, and just 1% in the meteorologists monitoring rainfall at the index station. These data echo sentiments expressed in the workshops in both Malawi and Ethiopia, the survey respondents indicated trust in both the product and the people involved in the product to be essential. They also echo data collected by a micro-lender in India, BASIX, examining what factors correlated with the decision to participate in a community insurance programme that BASIX offered. In this case, the two most important determinants were being a member of the local water association that was also participating in the program, and having been a previous customer of BASIX, both of which enhanced the level of trust in the program. As seen in Fig. 2b, their level of household income had a very small impact on their participation in the program: wealthier households were slightly more likely to want insurance (note that the economic model suggests that wealthier households ought to have less need for insurance), but the effect of doubling household wealth was less than 1% of the effect of the trust related variables.

3.3 Identifying farmer preferences: games in Peru and Kenya

Other studies have moved beyond the information available through workshops and surveys to gather contract preferences through repeated game play with farmers using the actual contract design. Researchers from the University Wisconsin, University of

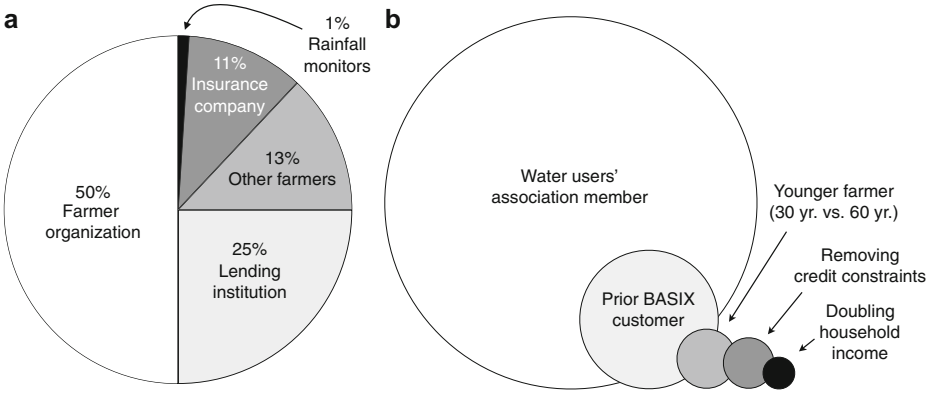

Fig. 2 Survey results from Malawi and India. Figure 2**a** shows the relative trust that farmers had in different people associated with the index insurance pilot scheme introduced in their communities. The graph is based on the results of a survey in which 168 participants were asked which set of actors participating in the insurance scheme they most trusted. The relative areas of the circles in Fig. 2**b** show the relative influence of different factors on the likelihood that a given farmer will purchase insurance. Having a higher income, or access to credit, made only a small difference, while being a prior customer of the insurance company, or a member of the community organization, made a large difference. The graph is based on the results of a survey administered in India by the BASIX company in coordination with the World Food Programme and the International Crop Research Institute for the Semi-Arid Tropics. The sample size was 1052

California-Davis, Syracuse University, Cornell University, the International Livestock Research Institute, and the Institute of Peruvian Studies have implemented two index insurance simulation games: one for cotton farmers in Peru and a second for pastoralists in Kenya. 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, and to capture compounding inter-annual risks that farmers faced.

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. The participants 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. In Kenya, the participant pastoral population is much less commercially oriented than the Peruvian cotton farmers and production credit is almost unknown, but farmers risk falling into a poverty trap if their herd size falls below a critical threshold. The game, in turn, was designed such that expected net heard growth was positive above the threshold and negative below the threshold.

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. Participant farmers appeared to find the payoffs and penalties in the game sensible, appeared to shape play within the game, and were at ease discussing (and in some cases disputing) the accuracy of the information used in the game. Through gameplay, farmers helped select the point at which insurance would cover losses, showing greater uptake when insurance covered a

moderate loss (85% of average yields), as opposed to when it covered higher (65% yield) or lower (90% yield) losses. In addition, these games provided information on sensitivity to price—farmers played the game at both actuarially fair prices as well as prices marked up by standard loading factors—and other innovative aspects of contract design, such as a non-linear relationship between rainfall and payouts that would lead to higher frequency payouts. Gameplay also provided valuable information about changes in risk-avoidance; when insurance was an option, more farmers played a higher-risk, higher-return strategy.

A similar game in Kenya investigated the demand for insurance among pastoralists. 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.

In creating an opportunity for farmers and pastoralists to test out the impact of insurance on their outcomes, this research has contributed to farmer understanding of insurance, design of insurance contracts, assessment of demand for insurance, and the understanding of the impact of insurance on risk-taking (Carter et al. 2008). The results do suggest that as farmers become more familiar with insurance in the context of a game, they become more sophisticated at doing the economic analysis to identify whether a given contract design makes sense for them. Research is currently underway to determine if these game findings accurately predict real world transactions.

3.4 Games to help educate in Ethiopia and Malawi

Given the evidence that games and workshops provide valuable information about index insurance, several researchers decided to test the ability of such games to act as educational tools to communicate key elements of the insurance concept. The World Food Programme and International Fund for Agricultural Development have sponsored a series of similar games, played with farmers in Ethiopia and Malawi. Like the games in Peru and Kenya, they framed the game in terms of rainfall, yields, and insurance, and captured compounding inter-annual risk, although the exact parameters were not tied as closely to local conditions. The 278 participants in these studies were randomly assigned to two groups. The control group received an oral presentation on the structure of index insurance, answering common questions about how such contracts function. After the presentation, they took a comprehension test, structured as a series of true/false questions covering fourteen concepts about index insurance. If they had understood the presentation, they would have been able to answer all of the questions correctly. The experimental group did not receive an oral presentation about insurance, but rather played an insurance game, structured very similarly to the one used in Peru. After playing the game, which occupied the same amount of time as the control group's education, they took the same test. Thus the experiment yielded two sets of data. The first was how farmers in the experimental group played the game, and the second was the relative effects of game playing and verbal explanation on participants' understanding of how insurance operates.

As in Peru, farmers playing a game framed explicitly in terms of rainfall, yields, and insurance seemed to make reasonable decisions. Most participants purchased insurance, and their decisions to do so responded to the inter-annual risk levels: those in greater risk of going bankrupt, and being ejected from the game, were more likely to purchase insurance. At the same time, neither group did very well on the test questions, and were not statistically different from each other. Of the fourteen question categories, there was one

category where participants' responses were significantly worse than guessing, five categories where they were indistinguishable from guessing, and eight categories where participants in both groups did somewhat better than guessing, providing up to 70% correct answers. Comparing the two data sets, those participants in the game group who answered more questions about the basic concepts of insurance correctly were more likely to have purchased insurance in the game. Thus, while those who understood insurance well enough to analyze it economically were more likely to purchase it, many who did not seem to understand its basic concepts at all—and thus could not analyze its expected benefits—still made decisions that appeared to be rational. This would suggest that decisions guided by heuristics can give rise to behavior that appears to be quite close to those guided by careful analysis, even if the processes underlying the decisions are very different.

4 Discussion

The four sets of field experiences described above were primarily aimed at understanding the factors that could make index insurance more or less attractive to farmers. The games in Brazil were at the most abstract level and designed to test theory, while those in Peru and Kenya were the most concrete, and used to test specific contract designs. Across the four sets of experiences, it is clear that both economic and non-economic factors play a role in people's decision to purchase insurance.

4.1 Making insurance economically attractive

The field experiences all suggest that there are ways to make insurance economically attractive. Two factors appeared to be important: the cost of the premium, and the timing of the premium.

In the games, where liquidity was not an issue, the cost of premiums appeared to be the most important element for farmers, one that could make or break an insurance contract. In the economic calculus, which farmers participating in Peru and Kenya revealed, the premium has to be fair, in terms of being fairly close to the expected payout. Consistent with bounded rationality, however, the insurance premium also had to be affordable, one that did not have a noticeable impact on farmers' incomes, independent of expected losses. This may mean that farmers living on marginal land, where the likelihood of a failed crop is so high that even an actuarially fair insurance contract will seem too expensive, may simply not want to participate in an insurance market. More work is needed to explore whether these results from the games are replicated in field trials involving actual insurance contracts.

In the surveys and interviews, the timing of both the premiums and the payouts made a large difference to farmers. In Ethiopia, farmers said that they would have little problem with paying premiums, but that the timing of the premium was an issue, since they only reliably have available cash just after harvest. Because they rely on having cash available at particular times, farmers in both Ethiopia and Malawi confirmed that they would prefer the payouts from insurance to mimic the timing of their cash receipts from their crops. Another way of guaranteeing liquidity is to bundle insurance with a loan. Interestingly, the timing of the expected payout did not arise as a crucial issue, although it is to be expected that this is important.

4.2 Enhancing trust

The experiences suggest that enhancing trust is a crucial design element of an insurance programme, and is consistent with past research we have cited on other types of

microinsurance. The first way to enhance trust is to help farmers understand the product that they are buying. It is crucial that they understand that the insurance carries with it basis risk, meaning that they may suffer a loss that is not covered by the insurance, and that they understand that they will probably pay more money into the insurance than they will receive out. The understanding of these issues need not be explicit, but can developed through experience, such that they are not surprised when these events occur. It is likely that few westerners, for example, actually think about the relative sizes of their premiums and their payouts when they purchase automobile insurance, but would nevertheless be unsurprised to learn that the former are greater than the latter. This kind of intuitive understanding comes from personal experience, and not from verbal explanation. There probably is a role for continued use of games as education tools, even if they do not lead to better explicit understanding of insurance concepts.

The second kind of trust that is important is trust in institutions. The experiences suggest that different kinds of institutions enjoy greater or lesser amounts of trust, but that in general trust increases with experience, and also that farmers tend to trust the organizations that they themselves are members of. There are good reasons, then, to piggyback insurance programmes onto pre-existing programmes with successful track records, especially ones that involve farmer organizations in important functions.

What is absolutely vital is to make sure that events do not occur that destroy trust, as these could kills the possibility of a viable market, both in the community where the events occur, and in other communities where farmers learn about them. For this reason, there is an important role for regulation, either by the government or the insurance industry itself. The regulation needs to ensure that contracts are in all cases fair, that they are accompanied by transparent information, and that claims will be paid in a prompt and reliable manner. Of course, the need for adequate regulation cuts across the entire financial services industry. What makes it especially important in this instance is that index insurance represents a complicated financial derivative being sold to relatively uneducated and inexperienced customers, where trust likely plays an especially important role in maintaining the market.

5 Conclusion: scaling up from pilot projects

We have reviewed both economic and non-economic theories that describe the factors that could make index insurance attractive to developing country farmers, and a set of case study experiences that, by and large, confirm aspects from both. From this, we have suggested practical steps that can be taken to make index insurance more attractive, both in the design of contracts, and the choice of institutions to implement those contracts. This comes at a crucial time, because outside of India, where micro-insurance for small scale farmers has become commonplace, there may finally be the opportunity to scale up from pilot projects to full fledged national programmes. A number of funding organizations appear to be moving in this direction.

In the process of scaling up, our results suggest, it is crucial to keep two factors in mind. The first we have already mentioned, and that is the need for regulation. It is crucial that the commercial actors in index insurance markets be honest players, and that their actions contribute to trust in the product, rather than destroying trust. A single bad example could set index insurance development back by many years. Exactly how such regulation is structured is beyond the scope of this article, but there is certainly a great deal of room for research.

The second issue is not as obvious, and that is the need to replicate much of the interaction that has taken place with farmers, even in the context of scaled-up programmes.

In pilot projects, participation is a way to gain information about farmers' needs. It has done this, and there could be the tendency to use that information to structure large programmes. But communication in participatory processes goes in two directions, and for this reason participation serves another function: it plays a crucial role in enhancing the trust in the institutions that are marketing insurance, in the insurance product itself, and of the farmers in their own decisions to purchase insurance. That trust is not a trivial piece of the decision to purchase insurance, and must not be ignored. But without this attention to communication, perhaps included the types of games we have described here, there is a large chance that farmers will be unreceptive to a product, even one that has been designed based on past participatory interactions. A critical challenge will be to balance this with the need to keep transaction costs low. It will take time and effort to design participatory processes that can be duplicated at low cost in community after community, perhaps combining them with crop fairs and other agricultural extension events, and this would be a valuable next step for research.

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