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# Index Insurance for Managing Climate-Related Agricultural Risk: *Toward a Strategic Research Agenda*

WORKSHOP REPORT • DECEMBER 2011

*Francesca de Nicola*  
*Ruth Vargas Hill*

*In Collaboration with*

*Michael Carter*  
*Richard Choularton*  
*James Hansen*  
*Daniel Osgood*

In October 2011, the CGIAR program on Climate Change, Agriculture and Food Security (CCAFS) and the Index Insurance Innovation Initiative (I4) organized a joint workshop hosted by the International Food Policy Research Institute (IFPRI). The workshop was designed to identify and address issues surrounding index-based insurance for smallholder farmers and the rural poor in the developing world. Emphasis was placed on identifying key areas of research and learning for the academic and policy community to pursue. The workshop took as its starting point the idea that there is large potential in using indices to insure smallholder farmers. However, in practice, the costs of providing and scaling up index insurance have not been insubstantial. In view of this potential and these constraints, workshop participants identified key areas of research and learning aimed at increasing the benefits of index-based insurance to smallholder farmers and the rural poor in the developing world. This report summarizes the findings of the two-day workshop.

## INTRODUCTION

In October 2011, the CGIAR program on Climate Change, Agriculture and Food Security (CCAFS) and the Index Insurance Innovation Initiative (I4) organized a joint workshop hosted by the International Food Policy Research Institute (IFPRI), to:

- Identify the most important gaps in, e.g., knowledge, methodology, tools, observations, evidence, capacity or coordination that currently limit the benefits of index-based insurance to smallholder farmers and the rural poor in the developing world;
- Contribute to an agenda for strategic research to address those gaps; and
- Inform a partnership and value-addition strategy for the CCAFS program.

The organizing committee for the workshop included representatives from CCAFS, I4, IFPRI, the International Resources Institute for Climate and Society (IRI) and the World Food Program (WFP). Participants at the workshop also included representatives of academic institutions, the Food and Agriculture Organization of the United Nations, Oxfam, Syngenta Foundation, the United States Agency for International Development, and the World Bank.<sup>1</sup>

The workshop took as its starting point the idea that there is large potential in using indices to insure smallholder farmers. Traditional indemnity insurance has been found to be unsustainable throughout the developing world, as a result of moral hazard, adverse selection, and the high costs of loss assessment for farmers who operate on a small scale. Index insurance reduces moral hazard and adverse selection and eliminates the need for on-farm loss assessment. In practice, however, the costs of providing and scaling up index insurance have not been insubstantial, and the basis risk associated with index insurance substantially reduces the quality of the product and thereby demand.

In view of this potential and these constraints, the workshop focused on identifying key areas of research and learning for the academic and policy community to pursue. Five areas of research emerged from the two days of discussions:

**Theme 1: Achieving optimal risk management.** What is the optimal set of risk management tools needed in order to see impact on specific development objectives: resilience to climate shocks, comprehensive social protection, investment in new agricultural technologies, more effective financial services? How should risk management interventions be sequenced to meet these goals? What is the relative importance of index insurance?

**Theme 2: Improving index insurance design.** Basis risk is problematic for both farmers and insurers. How do we design index insurance with less basis risk? What are the best strategies for dealing with poor-quality or missing data? If we are encouraging behavior change (either investment in risk mitigation or adoption of new technologies), how do we design indices that cover the risk associated with modified behavior?

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<sup>1</sup> A participant list is provided in the Appendix.

**Theme 3: Understanding behavioral and economic constraints to individual uptake for index insurance.** What constrains demand and limits repeat purchases of insurance? What are the relative roles of economic factors—such as price, liquidity constraints, and basis risk—and behavioral explanations, such as an aversion to ambiguity?

**Theme 4: How can individual index insurance be scaled and sustained?** How can index products be designed for scale? What is the long-run cost structure of index insurance, and how many of these costs arise from reinsurance costs and missing data?

**Theme 5: Learning how to insure services and institutions.** How can index insurance be used to insure the services and institutions of rural households? How can index insurance promote social protection? Can index insurance insure governments and their services, or the services provided by the private sector to agriculture? What is the role of groups in insurance provision?

In the remainder of this workshop report we summarize the main issues discussed and outline the directions for further research that emerged from the workshop discussions. Key research questions are highlighted to the side of the text. A companion background paper provides further details on the current research on this area, as well as technical suggestions for future research.

## **THEME 1: ACHIEVING OPTIMAL RISK MANAGEMENT**

The first theme that emerged from the workshop was the importance of considering and evaluating index insurance as part of a set of risk management tools, and understanding how it interacts with other development interventions, rather than as a stand-alone product that will solve the risk management needs of smallholder farmers.

Taking this approach requires a clear understanding of the ultimate development objective. What are the changes that we want to see and that will determine whether the provision of insurance was successful? Four objectives were identified during the workshop discussions: resilience to climate shocks; comprehensive social protection; investment in new agricultural technologies; and more effective financial services.

Some of these goals overlap and some are contrasting. For instance, the provision of weather index insurance might encourage the adoption of high-return but high risk production inputs, such as fertilizer and hybrid seeds. Although these inputs may be risky in the short-run the financial surplus that they generate has the potential to reduce livelihood risk in the long-run. Alternately, weather index insurance might be implemented along with other interventions to *reduce* risky agricultural techniques. In most cases, weather insurance is implemented with the goal of bringing about behavior change: enabling increased access to credit, investing in agricultural production, or investing in climate risk reduction. In some cases this behavior change may be encouraged by another development intervention (such as increased access to inputs, better integration into output markets, other adaptation interventions) implemented separately or alongside weather insurance.

Since the ultimate development goal may be achieved through alternative strategies,

*What is the role of insurance in the overall package, the optimal combination of insurance and other interventions, and the right order of sequencing?*

*What are the behavioral changes that result from combining credit and insurance, and do the two products need to be explicitly combined to achieve these results?*

*What are the complementarities between insurance and savings, and index insurance and social protection interventions?*

conducting research that helps policy makers choose the most efficient and effective combination of financial instruments and development interventions to support is a necessary but non-trivial exercise. Research is needed on the role of insurance in the overall package, the optimal combination of insurance and other interventions, and the right order of sequencing.

### **1.1. Synergies: insurance, credit, savings and social protection**

The discussion focused around synergies between insurance and other financial instruments that can be exploited to more effectively and efficiently reach a shared goal. In particular, discussants addressed the relationship between insurance and credit, saving, and social protection.

- The provision of insurance and credit together has a strong empirical and theoretical rationale: without insurance, farmers may be reluctant to take credit; similarly, without insurance, banks may be unwilling to lend to agriculture. EPIICA and Syngenta are interesting examples of programs offering weather index insurance in combination with credit (see Boxes 1 and 2 for more detail). In both cases, insurance is mandated at the time the loan is taken. This is a promising strategy to stimulate additional investment in fertilizer and other productive inputs. It may also be a way of encouraging take-up of index insurance. Further empirical research is needed to explore the behavioral changes that result from combining credit and insurance, and whether the two products need to be explicitly combined to achieve these results. The Syngenta example (Box 2) raises the interesting question of whether it is important to explicitly link the credit and insurance with the new production technology, as this intervention addresses credit, insurance, and input supply constraints at once.
- Index insurance and savings may efficiently complement each other. The former provides coverage against covariant shocks that affect many households in one location at once, while the latter can be used to manage idiosyncratic shocks that are unique to a given household. In the presence of basis risk, the index (used to draft the insurance contract) does not completely capture the losses suffered by farmers. They may thus be willing to seek additional instruments to protect their production from adverse shocks. One possibility would be to invest in a saving account. Further research is needed on the degree of these complementarities between insurance and savings and the feasibility of implementation. For example, does combining insurance and savings encourage insurance demand, or improve savings rates? Does the combination result in more effective coverage, and can farmers afford both the insurance premium and savings? What are the merits of group savings versus individual savings for this purpose (as discussed below, in Theme 5)?
- We also need to better understand complementarities between index insurance and social protection interventions, such as conditional cash transfers. For example, weather index insurance may be appropriate for relatively richer farmers that can afford a commercially sold product. The poorest of the poor may be better served by a combination of insurance and social protection interventions. Complementarities between social protection and insurance are considered in Theme 5.

### **Box 1. Linking credit and insurance: the example of EPPICA**

Designed by the FAO in partnership with Nyala Insurance and Dashen Bank, the Ethiopian Project on Interlinking Insurance and Credit for Agriculture (EPIICA) aims at fostering the use of fertilizer. To achieve this goal, the project (currently at a pilot stage) will provide weather-contingent loans to farmers to pay for production inputs.

Dashen Bank will lend directly to cooperative unions that recruit farmers through kebele-level cooperatives in Northern Shoa, North & South Wollo, and Gojam, thus minimizing fixed administrative costs.

Nyala Insurance will offer rainfall and frost-based index insurance products to insure the loan contract. The insurance is intended to cover the costs of production inputs, rather than farm revenues. If the weather index triggers, Dashen Bank will receive the payout directly to pay down the size of the loan that the farmer owes.

*Source: "Interlinking insurance with credit to enhance smallholder agricultural productivity: a pilot application to Ethiopia" by Shukri Ahmed, Rene Gommès, Craig McIntosh, and Alexander Sarris. FERDI Policy Brief B23. 2011.*

### **Box 2. Linking credit, insurance, and input purchase: the example of Syngenta**

The Syngenta Foundation for Sustainable Agriculture offers a number of products to insure rural farmers in Kenya. One of their products is offered in partnership with UAP Insurance and Kenya Women Finance Trust Limited (KWFT), to provide weather index insurance and credit to farmers in rural Kenya for the purchase of inputs in potato production. KWFT makes loans to member farmers in the form of vouchers to be spent at local input supplier for seeds, fertilizer, and insurance.

This bundled insurance-credit- seeds product is popular with farmers, accounting for about 80 percent of Syngenta Foundation's total insurance sales. In addition, this marketing strategy allows Syngenta to substantially subsidize the insurance premium, given the negligible marginal cost in providing seeds.

The provision of credit and insurance seems to have led to gradual changes in agricultural production technologies used. During the first year of sales, farmers began using fertilizer; next, they adopted certified seeds; finally, in the most recent year, they also purchased herbicides.

*Source: Kilimo Salama, Agricultural Insurance Initiative Kenya, presented by Wairimu Muthike*

## **1.2. Synergies between financial and non-financial interventions**

There are also many non-financial interventions—such as irrigation and crop diversification—that improve the ability of small-holder farmers to manage their risk. As such there are synergies between non-financial and financial interventions.

Additionally, as noted in the introduction to this section, index insurance is often implemented with a view to bringing about behavior change and this behavior change can sometimes best be brought about when index insurance is implemented alongside a non-financial intervention, such as improvements in access to input or output markets, or training farmers on improved production technologies. As noted in the discussion of the Syngenta example, it is important to consider the availability of production-enhancing inputs. Additionally, in the case of the HARITA project in northern Ethiopia (Box 3), index insurance has been provided with investments in terracing and bunding to reduce exposure to rainfall risk. Further research is needed to understand what non-

*Further research is needed to understand what non-financial interventions are best suited to be packaged with index insurance to achieve the overall development goal.*

financial interventions are best suited to be packaged with index insurance to achieve the overall development goal.

### **Box 3. A holistic approach to weather risk management: the example of HARITA**

Since 2009, the Horn of Africa Risk Transfer for Adaptation (HARITA) has been operated in Ethiopia by Oxfam in partnership with Swiss Re, the Relief Society of Tigray, Columbia University's International Research Institute for Climate and Society (IRI), Nyala Insurance and Dedebit Credit and Savings Institution.

The project has promoted a holistic approach to farmers' risk management, combining three interventions. First, it has promoted, as risk-managing technologies, the adoption of improved agricultural practices and conservation activities, such as soil improvement, water harvesting, and composting. Second, it has sold weather index insurance in order to transfer production risk from farmers to the insurer (and then to the re-insurer). Third, it has provided credit along with insurance and savings to encourage risk-taking in agricultural production.

In addition to its holistic approach, a unique aspect of the program consists in allowing farmers who participate in the food-for-work component of the Ethiopian Government's Productive Safety Net Program to pay for the insurance premium with labor on public works that reduce climate risk exposure (such as terracing and bunding).

*Source: Rural resilience series: Horn of Africa Risk Transfer for Adaptation (HARITA) project report, November 2007–December 2009, by Oxfam*

## **1.3. Sequencing considerations**

Understanding the optimal sequencing of risk-management interventions is a fertile research area. The following testable proposition emerged during the workshop: while weather index insurance may be useful at the initial stage of development—allowing subsistence farmers to curb the production risks they are exposed to and inducing more productive allocation of their investment—as farmers grow out of poverty, they may eventually graduate from their need of index insurance by adopting alternative agricultural production technologies that mitigate the impact of weather variations on output. For example, richer farmers are able to finance investments in irrigation systems that will reduce their dependency on rainfall to water crops. Research undertaken as part of the Index-Based Livestock Insurance (IBLI) scheme in Kenya shows that whilst well off herders may benefit from livestock insurance, moderately well-off herders will benefit the most as the insurance will protect them from losing livestock that puts them into a vicious poverty cycle. Conversely, gains from livestock insurance are likely to be minimal for poorer households who have so few livestock that they are already in a poverty cycle.

An additional open question concerns the possible spillover effects generated by the marketing of index insurance. In principle, the supply of insurance may foster rural financial markets. Starting with its provision, farmers may become more familiar with financial products in general, and this may further stimulate demand for other financial instruments, such as savings accounts.

## **1.4. Strategies for assessing optimal risk management**

Knowing how to achieve optimal risk management requires that we can assess the

*Understanding the optimal sequencing of risk-management interventions is a fertile research area.*

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*Knowing how to achieve optimal risk management requires that we can assess the impact of insurance, or insurance plus another intervention, on development outcomes.*

*The impact of insurance on behavioral change in the long and short run can be analyzed through randomized control trials and structural models.*

impact of insurance, or insurance plus another intervention, on the outcome of interest. For example are households better able to smooth consumption? Are households more resilient to climatic shocks when they occur? Has the desired behavior change taken place—have farmers increased their investment in high-return technologies, have households diversified production, have they invested in irrigation?

Behavioral changes may occur quickly or they may take five to ten years; studies need to be designed to consider both the immediate and the long-run effects. The impact of insurance on behavioral change in the long and short run can be analyzed through randomized control trials (RCTs) and structural models. RCTs allow us to estimate the welfare and behavioral impact of single or multiple interventions.

Estimates of impact from RCTs provide a clean way to answer the question about the impact of a specific intervention and synergies between one intervention and another. Unexpected findings from RCTs about impact can provide further insights into the constraints and opportunities facing smallholder farmers. Extrapolating from the results requires either many trials (which is very costly and time-consuming, but important for some questions) or the development of theoretical work alongside the trials to inform the treatment arms, and to help extrapolate findings outside of the original experiment.

Structural models can provide insights about behavior change and long-run consequences without the need to wait five to ten years. Additionally, the analysis of weather index insurance currently abstracts from considering long-term general equilibrium effects, and structural estimation can help bridge these gaps in knowledge. However, poor calibration or model misspecification may misguide the forecast; it is therefore important to verify and complement the insights from structural models with long-run RCT studies investigating long-run effects from the provision of insurance. Obtaining clear model predictions comes at the cost of imposing simplifying assumptions to ensure both tractability and clean identification of the key mechanisms at work. The use of RCTs should therefore be preferred to estimate features that are difficult to model but play an important role in the adoption of index insurance, such as trust in the insurer or understanding of the product.

## **THEME 2: IMPROVING INDEX INSURANCE DESIGN**

The utility of index insurance in helping smallholder farmers manage their risk will depend on how well the index reflects farmers' losses. In this section we consider research questions surrounding the design of index insurance, focusing on the selection of the index, data challenges and touching on some elements of contract design. Before discussing the index insurance design, we first consider the production risks that farmers face. Figure 1 provides a schematic presentation of three components of production risk:

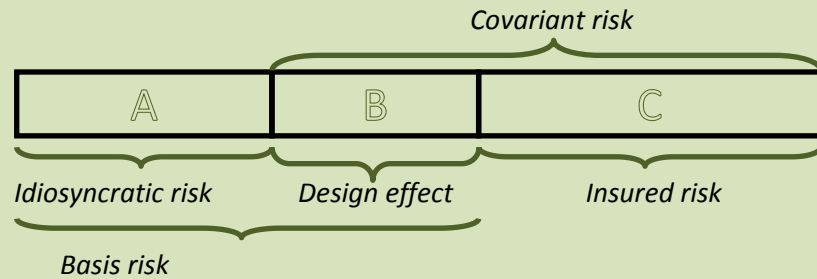
Covariate risk, which is insured by the index contract: for example, deficit rainfall risk or average area yield risk over a district (denoted "C");

Covariate risk left uninsured by the index contract: for example, pest infestation, in the case of a deficit rainfall contract, or a production shock only affecting part of the district in an area yield contract (denoted “B”); and

Idiosyncratic risk uninsured by the index contract: for example, ill-health that resulted in reduced household labor for production (denoted “A”).

Basis risk is defined as everything that is left uninsured by the insurance contract and that affects farmer yields—that is, the sum of “A” plus “B.”

**Figure 1. Decomposition of production risk into its covariant and idiosyncratic component**



*Note: The area “A” represents the amount of idiosyncratic risk, while the area “B” plus “C” represents the covariant risks: “B” is the portion of the shock left uninsured because of design effect and “C” is the portion actually insured under index insurance. Basis risk, defined as the risk that farmers’ actual losses are not compensated by the index insurance payout is therefore given by the area “A” plus “B.”*

*Source: Michael Carter*

Basis risk is problematic for both farmers and insurers, hindering both supply and take-up of insurance. It can be theoretically shown that farmers acting as utility-maximizing agents should buy minimal amounts of insurance when basis risk is high. On the supply side, it has been observed empirically that insurers prefer not to sell insurance product when the basis is high, in order to avoid negative spillovers to other insurance products offered. Refusing compensation when the index is not triggered, even though the insured suffered a loss, reflects badly on the insurance provider and affects future sales of index insurance as well as other insurance products.

It is important to think creatively about ways to minimize basis risk. Index insurance will not be able to help farmers manage idiosyncratic risk, but well-designed contracts can reduce the covariate elements of basis risk (shown as B in Figure 1). The current standard is well-designed and transparent weather indices, that pay out on the basis of too much or too little rain (measured at a nearby weather station or by satellite) and that incorporate agronomic principles as well as farmers’ feedback into the design. Another option, feasible only in some contexts, is area-yield insurance, in which payouts are determined on the basis of sample averages of realized yields.

In both cases, basis risk can be reduced either by moving to a smaller scale or by combining indices with loss assessment. One research project considers a multi-trigger design for an area yield contract in Mali (see Box 4). For a payout to occur, district-level yields must fall below a generous district-level trigger, and at that point village yields

*It is important to think creatively about ways to minimize basis risk. Further research is needed on ways to reduce basis risk.*



determine the payout amount. The idea is to expand “C” and reduce “B” in Figure 1, while avoiding problems of moral hazard. A possible adaptation would be a contract in which indices are used to inform the timing and location of loss assessments; payouts could be based on the assessments of the loss-adjustors. Further research is needed on such approaches to reduce basis risk.

#### **Box 4. Double triggers to reduce basis risk in Mali**

Cooperatives of cotton producers in Mali are currently being offered a double-trigger area yield insurance product, along with credit. The insurance payout is directly transferred to farmers’ bank accounts and is automatically used to repay the premium of the joint liability loan that finances the purchase of seeds, fertilizer, and pesticides.

The insurance contract has two interesting features. First, the payout schedule is determined by two triggers rather than just one. Yields at both the district and the cooperative levels need to be below their respective strike-points to trigger a payment. The presence of a second trigger reduces the probability of payout which allows the district strike-point to be increased without substantially increasing the cost of the premium. Using both triggers eliminates the probability of either a false positive (issuing an insurance payout when the cooperative yields are not low) and by allowing for an increase in the district strike point reduces the probability of a false negative (dismissing a payout request when cooperative yields are below the trigger).

Second, the insurance pays a lump sum. Positive experience in Peru, as well as the requests from local farmers, suggested adopting such a payment schedule instead of a linear one. The result is a simpler product whose potential is more easily understood: farmers can know precisely how much they will receive, should yields fall below the trigger. It also provides less scope for cheating on the measures of individual yields.

*Source: Group insurance for cotton producers in Mali, by Catherine Guirkingner with Marc Bellemare, Michael Carter and Ghada Elabed. FERDI Policy Brief B38. 2011.*

An ideal index insurance contract closely maps the level of losses suffered by the insured with the level of insurer payout for the given shock covered, and at the same time is affordable and understandable by the target population. Such a contract is hard to design; in order to gauge the optimal design it is necessary to understand how costly the deviations from the optimum are. For example, what are the tradeoffs between simple indexes and basis risk? What are the tradeoffs between affordable contracts and downside basis risk?

The design of index insurance thus depends crucially on the correct specification of the loss function (the relationship between the index and the losses suffered by the insured). However, to the extent that index insurance induces behavior change (as indicated in Theme 1), information on historical losses is inadequate to inform the appropriate design of index insurance. If, for example, index insurance encourages the use of a new seed variety, information on past rainfall and yields (using the old seed) will not help us understand the loss function for new seeds. Similarly, it may be the case that the loss function for farmers who have invested in terracing and bunding is quite different from that of other farmers. Further research on loss function under behavioral change is needed in order to design insurance that enables behavior change. In particular, can indices be designed so that those farmers who have invested in risk-reduction can purchase a cheaper product that is tailored to their new lower levels of

*In order to gauge the optimal design it is necessary to understand how costly the deviations from the optimum are. For example, what are the tradeoffs between simple indexes and basis risk? What are the tradeoffs between affordable contracts and downside basis risk?*

*Can indices be designed so as to capture the losses incurred when behavior is changed? Or so that those farmers who have invested in risk-reduction can purchase a cheaper product that is tailored to their new lower levels of risk?*

*It is crucial to better understand the specific effects of using sparse data in constructing indexes, and how missing data points can be interpolated.*

*What is the best practice in pricing index insurance in the context of a changing climate? Are current de-trending techniques sufficient?*

*We currently still lack a full understanding of what drives insurance uptake. Seemingly low levels of demand in some contexts may be optimal responses to poorly designed or expensive products. They may also indicate other constraints to demand that are not yet well understood.*

risk?

The data requirements and challenges for optimal design were also discussed—in particular, the problem of missing data, and the role of climate change in pricing insurance.

- The design and pricing of insurance relies on accurate long-term times-series data, but such data can be hard to find. Designing an index based on unreliable or incomplete information may jeopardize the development of an index insurance market. It is crucial to better understand the specific effects of using sparse data in constructing indexes, and how missing data points can be interpolated. In addition, yield data may be highly politicized, and thus either inflated or deflated from the true average yield. It was suggested that it is best to avoid engaging in index insurance activities in contexts where the essential information is lacking or too imprecise, to avoid damaging the reputation of weather index insurance as a reliable risk-managing tool.
- Trends in yields or weather risk, such as those entailed in climate change, can modify the distribution of shocks, in particular increasing the probability of extreme events. As a consequence, focusing on historical data alone results in under-pricing insurance. De-trending techniques can be used to minimize these concerns, but research questions remain about whether de-trending techniques are sufficient and what is the best practice in pricing in the context of a changing climate.

### **THEME 3: UNDERSTANDING BEHAVIORAL AND ECONOMIC CONSTRAINTS TO INDIVIDUAL UPTAKE OF INDEX INSURANCE**

In recent years a number of weather insurance pilots, RCTs and behavioral experiments have started to build an evidence base on insurance purchases among smallholder farmers. However, we currently still lack a full understanding of what drives insurance uptake. Seemingly low levels of demand in some contexts may be optimal responses to poorly designed or expensive products. They may also indicate other constraints to demand that are not yet well understood. During the workshop, economic and behavioral demand factors and supply-side constraints were mentioned. Further research is needed to better understand the relative importance of these factors, in order to focus limited resources on addressing the most pervasive ones to boost take-up of well-designed and cost effective risk management products.

#### **3.1. Economic constraints**

Research on the economic constraints to insurance demand has focused on basis risk, liquidity constraints, and the loading factor. Initial theoretical evidence shows that even charging an actuarially fair premium will not be sufficient to guarantee full insurance, if the contract is affected by basis risk. Initial empirical work highlights that demand is quite price sensitive, and therefore a high loading factor depresses demand. Discussions during the workshop indicate that the market price of insurance is typically 1.4-1.6 times the actuarially fair price. Such elevated insurance prices could be sufficient to drive

*Initial evidence needs to be complemented with further research on the credit-and-price elasticity of demand for weather index insurance, in order to shed more light on the relative importance of price and liquidity constraints.*

*How effective are behavioral games and endorsements by local leaders in educating farmers and generating demand?*

*Recent academic work suggests that distinct cognitive processes are activated when thinking about the insurance premium (that is paid with certainty) and the payout (that is received with an uncertain probability). More research is needed to understand the relative importance of such behavioral factors. Lab experiments can provide useful insights.*

down demand to the low levels observed. Empirical evidence suggests that credit constraints constitute another serious obstacle for insurance take-up. A promising solution to overcome this problem is offered in the HARITA project (Box 3), where poorer farmers are given the opportunity to pay for the insurance premium with labor. This initial evidence needs to be complemented with further research on the credit-and-price elasticity of demand for weather index insurance, in order to shed more light on the relative importance of price and liquidity constraints.

### **3.2. A behavioral understanding of low demand**

Ambiguity aversion, trust, and understanding are three determinants of demand generally studied in the behavioral literature. The experience of the Syngenta Foundation shows that involving local leaders in the marketing of weather index insurance largely increases the demand, overcoming possible trust issues about this new product. Similarly, offering a toll-free helpline to give information about insurance contributes to boosting confidence in the product among new consumers. To address possible problems of understanding, the farmers in the HARITA project benefit from a financial literacy intervention aiming to explain the various available tools to manage risks. Such a program is fairly expensive, however, and scaling it up is not an easy task. Thus, an important research question relates to the effectiveness of behavioral games in educating farmers and generating demand. The role of endorsements by local leaders could also be further investigated, to better understand how farmer learn about index insurance.

Some additional behavioral questions are central to understanding how farmers make choices about insurance, and particularly the cognitive constraints they face. For instance, recent academic work suggests that distinct cognitive processes are activated when thinking about the insurance *premium* (that is paid with certainty) and the *payout* (that is received with an uncertain probability). Such thinking processes may lower the appeal of insurance, as well as the estimation of its worth as risk-managing tool. Offering a rebate on the insurance premium may reduce these concerns, but field research is needed to better understand this aspect of decision making and to frame the appropriate design response.

While preliminary results show the importance of behavioral factors, more research is needed to determine their relative importance. Lab experiments can provide useful insights about how people make decisions under uncertainty, and specifically how they think about insurance purchase decisions. Similarly, RCTs are a suitable research tool to investigate the behavioral determinants of low demand in the absence of a well-established theoretical framework.

### **3.3. Index insurance buyers**

Who are the index insurance buyers? What are the characteristics of the targeted population? As suggested in the previous section, weather index insurance alone may not be attractive to the poorest of the poor among farmers. It may be appropriate for richer farmers with a larger agricultural investment to secure, rather than for subsistence farmers who could benefit more from social protection programs. Testing

*How does the per-unit cost and cost structure of providing insurance change over time and with scale?*

*Who are repeat buyers of insurance and what is the relationship between past payouts and current demand?*

*Research on index insurance has been primarily focused on small-scale pilots, and as such has not focused on addressing questions that are vital in going to scale.*

*How can high quality index insurance contracts be designed with minimal area-specific investments?*

the validity of this claim requires identifying the most important economic risks faced by farmers, and analyzing the risk-management tools available. This exercise would also inform the value of insurance relative to other approaches. For instance, if yield risk is not as important as market risk, alternative policy interventions should be sought that promote access to markets.

Who are the repeat buyers of insurance? The initial experience of the Syngenta Foundation indicates that repeat buyers account for about a third of the demand, thus suggesting gradual diffusion. The speed of this diffusion process is potentially affected by the frequency of insurance payments, given the common refrain heard during the workshop that “nothing sells insurance like a payout.” While the evidence in this regard is suggestive, the relationship between past payouts and current demand needs to be confirmed.

#### **THEME 4: HOW CAN INDIVIDUAL INDEX INSURANCE BE SCALED AND SUSTAINED?**

With the exception of yield and weather-based index insurance in India (where it is predominantly purchased as a mandatory fee on a loan taken for agricultural production), index insurance has not yet been sold to individuals at scale. Designing a product and sales strategy that can go to scale raises different questions than those raised in the implementation of a pilot. Research on index insurance has been primarily focused on small-scale pilots, and as such has not focused on addressing these questions that are vital in going to scale.

To maintain donor interest in the value of index insurance, an increased focus on approaches that not only have a demonstrated impact on farmers’ ability to manage risks (through research conducted at pilot scale) but also are fully scalable is needed, so addressing the following research questions is important.

- *Going to scale raises questions regarding index design.* How does one extend an index across new space without engaging in costly, time-consuming ground verification exercises every few kilometers? This is perhaps particularly a question for weather-index insurance contracts, where an estimation of the relationship between the weather index and yield losses is undertaken as part of the design process. It is also relevant for creating generic weather indexes, as training and educational information on how to combine them will be different in each new location. Research is needed on how to design high quality index insurance contracts with minimal area-specific investments in design or informational materials.
- *Changing cost structures over time.* Pilots have often come with considerable donor-financing to subsidize design, train farmers, provide information, and implement a sales strategy. A recent World Bank study shows that, when all these costs are accounted for, weather index insurance is not necessarily cheaper than traditional indemnity insurance.

Presumably, these costs fall over time as a project is implemented; however, little is currently understood about how the cost structure of providing index

*How can elements of index insurance best be incorporated in social protection schemes? Should indexed payouts for public works programs be provided? How should they be priced? Will farmers be clear enough about the payout conditions to be enabled and encouraged to invest in high-return activities?*

*Research is warranted to understand the capacity hurdles of the commercial financial sector and to identify viable options to address them.*

*How can index insurance build the resilience of rural households when it is used to insure the services they receive and the groups they are in?*

insurance changes over time. Indices require revision and improvement from year to year, as farmers increasingly understand how they work and offer suggestions on how to improve the design. Additionally, the costs of training and information dissemination have remained high, as have the costs of marketing the product.

A large part of the high costs of index insurance is the high cost of reinsurance for these products. This is largely related to the small scale of index insurance pilots (as there are fixed costs to any reinsurance transaction) as well as the small scale of the index reinsurance market, that limits both the potential for risk-pooling and the competition in the market. We do not have any evidence yet that per unit costs of reinsurance decline as the market expands, either locally or globally.

Research that affords a better understanding of how costs change over time and with scale is thus important.

- *Addressing capacity constraints of local service providers.* The capacity constraints of local financial services providers have not yet received much attention in the literature. Research is warranted to understand the capacity hurdles of the commercial financial sector and to identify viable options to address them. Some of the investments required in selling index insurance are non-proprietary (for example investing in the financial education of farmers) and will thus be difficult for a private insurance company to justify and invest in. The role of public subsidies or public-private partnerships in this regard is very important. A model used by Nyala insurance company in Ethiopia may be instructive here. In this model, the education and retailing costs are borne entirely by the public farmers' cooperative unions, and the insurance company deals with the cooperative union to issue the policy and make any payouts. Increased understanding is needed concerning how best to enable the private sector.

## **THEME 5: LEARNING HOW TO INSURE SERVICES AND INSTITUTIONS**

Much of the research on index insurance in recent years has focused on the design of index insurance products that are sold to individuals. However, index insurance can build the resilience of rural households when it is used to insure the services they receive and the groups they are in. In this section we summarize current experience on using insurance to insure services and groups, and highlight areas for further research in this area.

### **5.1. Combining index-insurance with social protection**

By providing payments to the poorest households, social protection schemes help many poor households survive. Ideally, social protection will also help protect the incomes or assets of these households when bad events occur, and will help these households invest in income-generating activities that enable them to exit poverty in the long run. Indexed payouts are one way in which a social protection scheme can better do this. Introducing an indexed payout to an existing social protection scheme offers two

principal advantages: (i) it ensures an additional payout to struggling households when harvests are generally poor; and (ii) secure in the knowledge that they will have protection in the event of bad harvests, participant households are more able to undertake high-return but high-risk investments.

In Kenya, the IBLI insurance product has been sold to households in a donor-funded social protection program as well as to non-participant households, to examine this potential interaction. In Ethiopia, participants of the government-run Productive Safety Nets Program have been able to engage in additional public works for an indexed payout (HARITA). Both are steps in the direction of designing a social protection program with indexed payouts.

The following research questions remain concerning how to combine elements of index insurance in social protection schemes: (1) Should indexed payouts be available for purchase (including with labor), in addition to the main scheme provision? (2) If so, how should the premiums be priced, and in particular what is the right shadow-wage to assume for valuing work-allocation? (3) If indexed payouts are provided to all (without opting in to the indexed payout), will farmers be clear enough about the payout conditions to be enabled and encouraged to invest in high-return activities?

## **5.2. Indexes and disaster risk financing to insure government services**

Even without a social protection program that explicitly links payouts to an index, governments often face increased budgetary pressures in the wake of widespread disaster. Emergency assistance is often required to those most affected by the disaster, and increased investments in infrastructure may be necessary (in the case of flood or wind damage). Both of these burdens may coincide with reduced government revenues as a result of the disaster.

Governments have multiple ways to cope with these budget constraints, each with different costs. Some disaster preparedness can be achieved by implementing more flexible budget structures and procedures. In addition, governments may borrow to finance expenditures following a disaster, although this strategy may be costly given the limited time available to negotiate convenient loan terms. Governments could allocate a portion of tax revenue to a specific fund for financing disasters, although this solution may not be politically feasible as pressures to divert monies from the fund to other purposes may be hard to resist. Alternatively, governments could purchase indexed securities that would guarantee cash quickly, in exchange for an annual premium. (Box 5 describes Mexico's insurance program.) The drawback in this case is that insurance is expensive and will be hard to justify politically, given that the benefits may not be observed for many years. Finally, governments may pre-arrange a line of credit contingent on either a predetermined extreme weather event (hard trigger) or the declaration of a state of emergency by the government (soft trigger). This provides quick financing in the case of a disaster at a much lower cost than insurance alone.

A combination of all of these measures is likely needed. Several aspects of risk financing for government services call for further research: How much risk should be

*How much risk should be transferred in disaster risk financing schemes? What mechanisms need to be in place to ensure that payouts are well used by local and national governments?*

transferred under each of these mechanisms? How should risk be transferred to international markets? (For example, does it make sense to have a risk-sharing pool between sovereign states—such as the Caribbean Catastrophe Risk Insurance Facility — or should governments sell their risk directly to private reinsurance companies?)

#### **Box 5. Insuring local government budgets in Mexico**

Agroasemex is a decentralized governmental agency that was formed in 2001 and operates as the only provider of weather index insurance in Mexico. Agroasemex designs indexes for specific crops and regions by combining crop models with good quality, publicly available rainfall information. Although more than 5000 weather stations are available in the country, Agroasemex exploits only those that meet international standards and have more than 25 years of daily rainfall information.

The resulting indices are used to provide insurance to state governments to insure their fiscal budgets. During crises, payments can either be distributed to farmers or spent on infrastructure as needed. At the national level, insured risk is sold to the international reinsurance market.

*Source: Drought and Retribution: Evidence from a large scale Rainfall-Indexed Insurance Program in Mexico, by Alan Fuchs and Hendrik Wolf. Mimeo, University of California at Berkeley.2010.*

What mechanisms need to be in place to ensure that payouts are well-used by local and national governments? (Very little is known, for example, about how transfers from the central government to local governments in Mexico are allocated and provided to households.)

### **5.3. Insuring privately provided services for rural households**

Just as it is important to insure the provision of government services, it is also important to insure the provision of private services to rural households—particularly services such as credit that may not be provided in the absence of insurance against climate-related risks. As described under Theme 1, the provision of insurance and credit together has a strong empirical and theoretical rationale as a way of addressing both supply and demand constraints. Providing insurance to farmers as they take credit is one option, but this requires that any insurance payout will go to pay back the loan amount due to the bank. Alternatively, one can work directly with banks to help them manage the risk they hold by making agricultural loans. Banks can purchase index insurance to insure this risk—and guarantee to farmers that they will not ask for repayment when index insurance pays out.

One challenge will be to find ways to ensure not only that the bank covers its risk, but also that the bank assigns its own payouts to cover the loan liability of farmers whose loans were covered under the insurance. Without firm guarantees, a situation could arise in which the bank both receives an insurance payout *and* asks farmers to repay their loans. One solution, piloted by the World Bank in Kenya, is to link index payouts directly to farmers' personal accounts. In this setup, any payout that is received by the bank automatically goes into farmers' accounts and goes first to pay down remaining farmer debt. Further work is needed to understand the implications of insuring banks directly on farmer demand for credit, and to understand whether it results in behavior changes on the part of insured farmers.

*What impact does insuring banks directly have on supply and demand for credit? Does it result in behavior change on the part of insured farmers?*

## 5.4. Insuring groups of farmers

Providing insurance to groups of farmers rather than to individual farmers could carry a number of possible advantages. Selling through groups reduces the costs of training and retailing insurance, and group leaders can help inform members and vouch for the insurance products being sold. The main advantage of selling to groups is that they can absorb some of the basis risk inherent in index-based products.

As discussed in reference to Figure 1, while index schemes can help farmers manage widespread climate risk, they are less useful in addressing idiosyncratic risks. By encouraging groups to manage idiosyncratic risk through group savings and lending, in combination with index insurance, the basis risk associated with index insurance is reduced from the amount A+B to only B. A description of this scheme in practice is provided in Box 6.

### Box 6. Insuring groups of farmers in Ethiopia

IFPRI, the University of Oxford, and Buusaa Gonofaa MFI are conducting a RCT in Ethiopia to test the complementarities between index insurance and group based risk-sharing. The project explores the ability of pre-existing risk-sharing groups (in this case funeral insurance societies) to complement formal sector index insurance products with local risk pooling.

Index insurance products are sold to groups, and groups are trained and encouraged to use local information on member's crop losses to disburse larger payouts from group savings and loans to those with larger needs.

A group establishes a common savings pool. The pool is used to disburse loans at zero interest to members who have experienced an instance of idiosyncratic basis risk. The criteria for disbursement is discussed and set by the group at the start of the year. Examples are: a specific pest infestation; sickness of adult member that reduces productive work on the field during the season; hail, frost, or waterlogging. A member experiencing one of these shocks applies to receive a loan, and a decision is taken by an elected committee. Repayment occurs when the group member can afford it, or by a pre-specified date.

Source: IFPRI annual progress report to I4.

There are a number of questions regarding how and when groups can be used to provide insurance to their members. For example, is there a basic set of rules necessary to guarantee sustainable functioning? If so, what are they, and who should set them? What type of risk can be insured in this way? Can groups effectively manage risk category A (Figure 1)? How does the remaining uninsured risk (category B) affect them? Do groups help increase the insurance coverage of women, or do they limit access to the market by women if there is not equal opportunity within the group? Can special groups be set up to perform this function, or should pre-existing groups be used? What is the optimal size of these groups? What types of strategic behavior and moral hazard are likely to most affect the functioning of the group, and how can rules be designed to effectively mitigate these risks? Research is being conducted on a number of these questions in the IFPRI, Oxford and Buusaa Gonofaa insurance project in Ethiopia, but further research is needed to address the questions that arise.

*How and when can groups be used to provide insurance to their members? What type of risk can be insured in this way? Is there a basic set of rules necessary to guarantee sustainable functioning? What types of strategic behavior and moral hazard are most likely to affect the functioning of the group and how can rules be designed to mitigate these risks? Can groups increase women's access to insurance?*





## APPENDIX: WORKSHOP PARTICIPANTS

Name	Organization
Shukri Ahmed	Food and Agriculture Organization
Margaret Arnold	World Bank
Michael Carter	University of California at Davis
Richard Choularton	World Food Program
Alejandro de le Fuente	World Bank
Stephane de Messieres	Oxfam
Francesca de Nicola	International Food Policy Research Institute
Nora Ferm	U.S. Agency for International Development
James Hansen	International Research Institute for Climate and Society
Lena Heron	U.S. Agency for International Development
Ruth Vargas Hill	International Food Policy Research Institute
Olivier Mahul	World Bank
John McPeak	Syracuse University
Wairimu Elizabeth Muthike	Syngenta
Daniel Osgood	International Research Institute for Climate and Society
Miguel Robles	International Food Policy Research Institute
Marc Sadler	World Bank
Alemayehu Seyoum Taffesse	International Food Policy Research Institute

**Francesca de Nicola** is a Postdoctoral Fellow in the Markets Trade and Institutions division of the International Food Policy Research Institute (IFPRI), Washington, DC. **Ruth Vargas Hill** is a Research Fellow in the Markets Trade and Institutions division of IFPRI, Washington, DC. **Michael Carter** is a Professor in the Department of Agricultural & Resource Economics at the University of California and Director of the Index Insurance Innovation Initiative (I4). **Richard Choularton** is a Senior Policy Officer in the World Food Programme's Climate Change and Disaster Risk Reduction Office, based in Rome. **James Hansen** is a Research Scientist at the International Research Institute for Climate and Society (IRI) and CCAFS Theme 2 Leader. **Daniel Osgood** is a Research Scientist at IRI and lead scientist for the Financial Instruments Sector Team.

*Index Insurance*  
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### INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

2033 K Street, NW • Washington, DC 20006-1002 USA  
T +1.202.862.5600 • F +1.202.467.4439  
www.ifpri.org • Skype: ifprihomeoffice • ifpri@cgiar.org

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The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of the Consortium of International Agricultural Research Centers (CGIAR) and the Earth System Science Partnership (ESSP). The program is supported by the European Union, the United States Agency for International Development (USAID), Canadian International Development Agency (CIDA), New Zealand Ministry of Foreign Affairs and Trade, the Danish International Development Agency (Danida), the UK Department for International Development (DFID), Irish Aid, and Instituto de Investigação Científica Tropical, Portugal (ICT) with technical support from IFAD. For more information, please visit <http://ccafs.cgiar.org>

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