

Executive Summary

Index Insurance: Innovative Financial Technology to Break the Cycle of Risk and Rural Poverty in Ecuador

The urgent need to provide insurance to small farmers prompted the Ecuadorian government to initiate and heavily subsidize a conventional insurance program targeted at small farmers. However, there are a number of reasons to doubt the efficacy and sustainability of this program, including transactions costs, adverse selection, moral hazard and the likelihood that a complex individual claims process will make it hard for farmers to recoup their losses. This research project will explore the viability of index-based insurance contracts as an alternative to conventional insurance.

The primary goals of this project are to:

1. Evaluate the potential for alternative index-based insurance contracts to protect poor rural households' livelihoods and enhance their risk management capacity.
2. Work with the government and the insurance sector to support creation of sustainable index-based insurance markets for poor farm households.
3. Create an informed demand for agricultural insurance products by designing an educational and outreach strategy for the small farm sector.
4. Build capacity within government and the private sector for creating, supervising, managing, and deepening index-based crop insurance markets.

Our proposed project has two phases. Phase 1, for which we are seeking support from the Ford Foundation, responds to the need to learn about the feasibility of and potential demand for index-based insurance contracts and to develop the private and public sector capacity to create sustainable index insurance markets. We seek funding to carry out the following activities:

1. Carry out statistical analysis to design alternative index-based and hybrid 'shadow contracts';
2. Collect farm-level data to track and compare the virtual performance of these shadow contracts to the actual performance of the existing conventional contract; and,
3. Carry out a series of capacity-building workshops with government, farmer groups, and the insurance sector.
4. Give concrete recommendations to the Ecuadorian government and insurance industry about the most promising contracts that should be implemented or piloted to better serve the needs of the small farm sector.

In a second phase, we will support the roll out of the optimal contract(s) identified in the first phase and carry out impact evaluation around this contract.

Proposal Narrative

INDEX INSURANCE: INNOVATIVE FINANCIAL TECHNOLOGY TO BREAK THE CYCLE OF RISK AND RURAL POVERTY IN ECUADOR

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Index Insurance: Innovative Financial Technology to Break the Cycle of Risk and Rural Poverty in Ecuador

Project Summary

The urgent need to provide insurance to small farmers prompted the Ecuadorian government to initiate and heavily subsidize a conventional insurance program targeted at small farmers. However, there are a number of reasons to doubt the efficacy and sustainability of this program, including transactions costs, adverse selection, moral hazard and the likelihood that a complex individual claims process will make it hard for farmers to recoup their losses. Our proposed project has two phases. Phase 1, for which we are seeking support from the Ford Foundation, responds to the need to learn about other, perhaps more viable, options. We seek funding to:

1. Design alternative index-based and hybrid ‘shadow contracts’;
2. Track and compare the virtual performance of these shadow contracts to the actual performance of the existing conventional contract; and,
3. Give concrete recommendations to the Ecuadorian government and insurance industry about the most promising contracts that should be implemented or piloted to better serve the needs of the small farm sector.

In a second phase, we will support the roll out of the optimal contract(s) identified in the first phase and carry out impact evaluation around this contract.

Context and justification

Agriculture is a critical sector of the economy of Ecuador. In 2009, agriculture generated direct employment for 26.4% of the economically active population, contributed 7% to the GDP and generated nearly \$4 billion in exports. Given Ecuador’s privileged endowment of natural resources, agriculture’s contribution to poverty reduction and growth could be much greater. One of the key constraints limiting agriculture’s contribution is the high degree of weather related yield risk faced by farmers. For example, in 2009 a protracted drought adversely affected more than 200,000 hectares in the Sierra, while excessive rains and flooding as well as drought significantly lowered yields on 360,000 hectares on the Coast. Despite the presence of major risks, only 25,000 of Ecuador’s 7.5 million arable hectares were insured in 2009.

The virtual absence of crop insurance limits farmers’ willingness to invest and innovate. The cost of uninsured risk is particularly severe for small farmers whose ability to invest is already constrained by weak access to credit markets. The government of Ecuador seeks to address these costs and respond to the concerns of agricultural constituencies by promoting market-based risk management innovations for the small-farm sector. Currently, *Seguros Colonial*, a private insurance company, is the only

provider of crop insurance in Ecuador;¹ offering a conventional contract to a modest number of larger scale farms. In a pilot program, the government of Ecuador is working with Colonial to extend this individual-yield based contract to a larger number of small farmers by providing a 60% premium subsidy.

There are, however, a number of reasons to doubt the efficacy of this response. Similar efforts in other countries to implement individual insurance contracts for small-scale farmers are unified by their failure. The transactions costs of verifying small farm losses are large relative to insured values. Not only does this push up premium costs well above actuarially fair prices, the sheer difficulty of determining losses and their causes exposes the insurer to severe moral hazard problems. The result is either commercially non-viable insurance, or the creation of a claims process that makes it difficult for farmers to receive payments for legitimate losses. The individual contract being rolled out for small farms in Ecuador not surprisingly appears to be expensive and features a claims process with reporting and verification procedures that likely imply significant costs for farmers and may reduce effective insurance coverage. Determining precisely how this kind of insurance works in practice is one goal of this project.

Index insurance represents an innovative new financial technology that may succeed where conventional insurance has failed. In contrast to conventional insurance contracts, payouts under an *index* contract are not based on individual outcomes. Instead, they are based on the outcome of an aggregate index – such as average area yields, rainfall, or satellite information on plant growth -- that is correlated with individual farm outcomes. Using a data source that is promptly, reliably, and inexpensively available (and not manipulable by either the insurer or the insured), an index insurance contract makes the agreed indemnity payment to insured farmers whenever the data source indicates that the index reaches the “strike point,” or insurance activation level. Because it is not necessary to verify individual losses, transactions costs with index insurance are modest, a feature that is especially important if coverage is to be offered to small farmers. A second advantage of index insurance is that it preserves effort incentives for farmers because no individual farmer can increase the probability of an insurance payout by working less hard. In other words, index insurance does not suffer from moral hazard. The combination of low transactions costs and immunity from moral hazard suggests that the market should be able to sustainably provide index insurance to the small farm sector in the developing world.

The government of Ecuador is aware of the limitations of conventional insurance and is seeking alternatives. After members of this research team presented the logic of index insurance to government officials in late 2009, the Ecuadorian Ministry of Agriculture contacted us to design and carry out a two-phase research program in order to identify and implement alternative insurance for the small farm sector. The research program described in detail below is a result of this request and represents an important opportunity to help move agricultural policy forward on a strong evidentiary basis.

In addition to this important linkage, which should secure Ministry ownership over and interest in our results, we will also form a project steering committee designed to achieve the same thing with the relevant private sector actors. Specifically, the steering

¹ Out of the 44 insurance companies in Ecuador, only *Seguros Colonial* reported receiving any premiums from crop insurance. In 2008, those premiums represented only 0.11% of all paid premiums in the insurance sector.

committee will be comprised of representatives from the insurance industry, farmer organizations and rural microfinance providers, as well as from the government. This group will be convened early in the life of the project. The involvement of this group should not only improve the quality of the research, but it should also create a set of interested partners willing and able to help with the project outreach activities described below.

Finally, this project will be integrated into the ongoing work of the I4 Index Insurance Innovation Initiative housed at the University of California-Davis. The I4 and its affiliated network of researchers are currently implementing index insurance pilot projects in 6 locations around the globe. This project will directly benefit from the learning that is taking place under the I4. In addition, project participants and steering committee representatives will be invited to participate in an upcoming I4 meeting on index insurance to be held in Lima later this year.

Expected results and Success Indicators

Our analysis will provide options to the Ecuadorian government and the insurance sector. We expect to generate clear judgments of which product is best in terms of metrics that are meaningful to farmers. That is, we will evaluate which product provides small farmers the best livelihood value, which is a combination of effective cost, coverage level, low basis risk², and ease of understanding. The tradeoffs implicit across the different contractual options are real and significant. Designing and implementing an insurance program that is best suited to the risk management needs of small farmers requires a rigorous, empirically grounded analysis of these tradeoffs. This project aims to deliver precisely this type of analysis.

The indicators of success for the first phase of this project are the following:

1. *Design of an Optimal Index Insurance Contract for Smallholder Farmers*
After assembling the available data, we will design and evaluate alternative agricultural index insurance contracts appropriate for smallholder farmers, including weather-based contracts, area yield contracts, contracts based on remotely sensed (satellite) data and hybrid combinations of these. Farm household data will be used to pick the best contract using willingness to pay measures that consider both the risk reduction benefits and the economic costs of the different potential indices. We will also evaluate the value, via reduction of default risk, of the alternative contract to rural lending institutions.
2. *Empirically-based Analysis of the Performance of the Optimal Index Contract versus the Individual Multi-peril Contract Currently in the Market*
At the same time that we design and evaluate alternative index insurance contracts, we will also collect the data necessary to evaluate individual multi-peril contract currently being implemented through a partnership between the government of Ecuador and the private sector. The same willingness to pay analysis described in item (1) above will be used to evaluate the relative

² Basis risk is the risk that a farmer suffers a loss that is not covered by the insurance contract.

performance and value of individual versus index contracts.

3. *Preparation and Dissemination of an Agricultural Insurance White Paper for the Government of Ecuador*
We will prepare a concise policy brief for the Government of Ecuador and other interested parties on the optimal design of agricultural insurance for the Ecuadorian smallholder farm sector. The brief will not only consider the best contract (as described in item (2) above), it will also consider the appropriate division of labor between public and private sectors in the realm of agricultural insurance. Included here will be considerations on provision of information (e.g., on weather or area yields) as a public good, as well as the optimal ‘layering of risk’ between private and public actors. For example, it may make sense for private farmers to cover those risks associated with the viability of their agricultural enterprises, while the public sector might pay for the catastrophic risk layer as a form of social protection to guard families’ livelihood and long-term economic capacities. Our close cooperation with the Ecuadorian Ministry of Agriculture and other stakeholders will ensure that we have a ready audience for our presentation of the insurance white paper to a high profile event in early 2013.
4. *Technical Capacity Building for Sustainable Supply of Agricultural Insurance*
As a relatively novel product in Ecuador, agricultural insurance presents particular challenges to private insurance companies. The contract design and testing work that will be undertaken under this project will be a public good, and we will hold a workshop for the relevant actors so that they can fully understand principals of contract design and how they can build on our learning to expand the market for agricultural insurance to other regions using whatever contractual modalities prove most appropriate.
5. *Stakeholder Workshops for Farmer Associations and Rural Microfinance Institutions*
Agricultural insurance will have its biggest impacts when it is well understood by and influences the behavior of the two actors most closely related to agricultural productivity growth: Farmers themselves and rural microfinance institutions who can potentially provide the credit needed for technology acquisition and income growth in rural areas. Working with farmer organizations as well as with MFIs (and other rural market players), we will hold stakeholder workshops in each of the two agro-ecological areas where we will design and test alternative contracts. Workshops will be dedicated to helping stakeholders understand contracts and how they might affect their own business decision-making.

Once a viable insurance option is implemented, we can then anticipate three levels of impacts on smallholder households. First, the income protection provided by the insurance should allow households to protect their consumption levels during bad years, with the important implication that this protection should allow households to sustain their investments in the health, education and nutrition of their children. Second, the insurance should also underwrite greater entrepreneurial risk-taking by these same families, with greater investment in yield improving farming technologies and practices. Finally, a sustainable agricultural insurance system may also deepen the supply side of

the rural credit market, making it easier for smallholders to access credit needed for enhanced yields and incomes. Our longer-term goal is to evaluate these impacts, which will be the expected result of phase 2.

Proposed Activities

The overall research program is broken into two phases. In phase I, we will work with the Ministry to design and evaluate a range of index-based alternatives. As described above, the outputs of this first phase will include: a) The design of multiple index insurance contracts; b) A ranking across the existing conventional insurance contract and the index alternatives by their viability, sustainability and efficacy in removing risk for small farmers, and; c) A series of papers and workshops to disseminate results and build the institutional capacity required to develop a sustainable insurance market for small farmers. This first phase would take place between July 1, 2010 and June 30, 2013. Contingent on finding support for an index-based contract in the first stage, in the second stage we would support the implementation of the optimal contract and carry out an impact evaluation research program around the insurance. This second phase would take place between 2013–2015. The primary activities and required data sources for each phase are described in detail below.

Phase I: Design and Evaluation of Alternative Index Contracts

Phase I consists of the following three activities.

- ***Activity 1: In-depth analysis of Colonial's conventional crop insurance***
 - **Summary:** This activity has demand and supply side components. The supply-side analysis will evaluate the structure of the contract and the practices that agents and adjustors use to calculate and verify damages and pay claims. As such, it will evaluate the effective coverage offered by the contract. Some types of risks are not covered, other risks may be covered in theory but not in practice as certain claims are either rejected outright or effectively rejected by significant barriers or costs associated with making claims. The demand-side analysis will explore two issues. First, we will analyze the determinants of insurance demand; exploring the relative importance of conventional factors including wealth, education, risk aversion and farm and non-farm activity portfolios as well as non-conventional determinants such as farmers' trust in the insurance provider. Second, we will explore farmers' general understanding of the structure of the contract and the degree to which they correctly identify the circumstances under which indemnities are paid? Identifying farmer misperceptions of insurance contracts is crucial for market sustainability as mismatched perceptions can lead to low demand or frustration and the eventual collapse of the market.
 - **Data required:** The data from this activity will come from three sources. First, we will conduct extensive interviews with the personnel of *Seguros Colonial*. In addition to interviewing managers and actuarial specialists to better understand the design behind and the structure of the contract, we will interact extensively with insurance agents and claims adjustors to evaluate the practices and real-world implementation of the insurance that affect the

effective cost and coverage. Second, we will carry out a three-year panel survey of 1,000 farmers – including both insured and uninsured -- in the areas of operation of the Ministry’s pilot project. The survey will collect information on farmers’ insurance purchase decisions and the characteristics mentioned above that are hypothesized to affect demand. By following households over three years, we will be able to identify not only the key determinants of the initial purchase decision but also patterns of diffusion of insurance demand across space and farmer networks and determinants of becoming a repeat buyer. Third, we will conduct a series of focus groups with farmers – again including both insured and uninsured farmers -- in the study area to gain a deeper understanding of farmers’ comprehension of the insurance and their trust of the insurance provider. The direct and in-depth feedback from farmers will also provide key insights into farmer satisfaction with the marketing and information dissemination strategies of Colonial and will likely lead to recommendations for improving the insurance.

- *Activity 2: Design of alternative index and hybrid “shadow” contracts.*
 - Summary: In order to evaluate the viability of alternatives to conventional crop insurance, we will design three types of “shadow” contracts: Area yield insurance, Weather and/or satellite based index insurance and, Hybrid insurance combining aspects of conventional and index insurance. Within each general type, we will also develop contracts at different levels of spatial aggregation. This activity will consist primarily of statistical analysis to estimate the probability distribution functions of area yields and the satellite and weather indices. The distribution functions will then be used to generate actuarially fair premiums for the different contracts.
 - Data required: This activity will rely on secondary data. First, we will work with the agricultural statistics team within the Ministry of Agriculture to construct time series on yields for corn, rice and potatoes at the province and *parroquia* levels in the pilot areas. Second, we will construct time series of rainfall and other weather variables from the meteorological stations in the study area. Third, we will construct time series of several forms of satellite data including moisture and vegetative content.
- *Activity 3: Comparative performance analysis of conventional versus alternative insurance contracts.*
 - Summary: We will compare the effectiveness of the conventional insurance contract with the multiple “shadow” contracts designed in Activity 2. To do so, we will compare realized outcomes under the Colonial contract to outcomes if each of the shadow contracts had instead been offered. Specifically, for farmers who purchased the Colonial contract, we will compare the realized distribution of net insurance payouts (indemnity minus premium) against the distribution that would have obtained under each of the shadow contracts. Using the indemnity rules uncovered from the first activity, we will also compare the distribution of net insurance payouts if *all* farmers had purchased the Colonial contract against each of the shadow contracts. We will carry out this comparative analysis for each of the next three agricultural years.

- Data required: This comparative analysis will use the three year farmer panel data set described above. The data set, which will include a random sample of insured and uninsured farmers, will collect detailed information about farmers' yields and production shocks.

Summary of Phase I: The phase-I funding from this grant will be used for the three activities described above, which will require a multi-round survey applied to approximately 1,000 farmers at the conclusion of the next five major cropping seasons spanning the next two and a half years³ and comprehensive data work to design the shadow contracts. By the end of the first phase, we will be in a position to make well-informed recommendations to the Ecuadorian government and the insurance sector about which class of insurance contract would perform best for the small farm sector.

Phase II: Impact Evaluation of Index Insurance

While we are not here requesting funding for this second stage of activity, it is this longer-run plan that gives additional value to Phase I activities proposed here. Phase II itself will consist of implementing and evaluating the impacts of the optimal index insurance contract or contracts identified in Phase I.

- Activity 4: Impact evaluation of index insurance
 - Summary: After identifying the optimal index contract, a phased roll-out of the contract will be designed in coordination with the Ministry of Agriculture and the private insurance sector. The roll-out will be structured to facilitate the rigorous, quantitative evaluation of the impacts of the insurance on farmer welfare. Specifically, we will evaluate the impact of insurance on: 1) Access to and participation in credit markets; 2) Investment and technology adoption; 3) Farm yield and income; 4) Household asset accumulation; 5) Household consumption and; 6) Household investment in children's health and education.
 - Data required: We will carry out a three-year, farm household panel survey to measure impacts. The sample will likely be drawn from the 1,000 farmers surveyed in Phase I. While the Phase I survey will be relatively simple, focusing primarily on farm yields, the Phase II survey will include more detailed modules on investment, income, and expenditures. We will explore multiple strategies to identify the causal impact of insurance including spatially randomizing the roll-out of the insurance program and an encouragement design which randomly provides premium discounts to some farmers but not others.

Timetable of activities

The first phase of the project will take place between 2010 and 2012 according to the tentative timetable shown below⁴. Five survey rounds are considered based on the two

³ The dry season runs roughly from May through October and the wet season runs from October through April.

⁴ We will finalize the timetable, including the number and timing of survey rounds, after we more closely evaluate the fraction of farmers that plant in both wet and dry seasons in the specific survey areas.

agricultural cycles in Ecuador (i.e., wet and dry seasons) and the harvest periods for the crops included in the project (rice, corn and potatoes).

	2010						2011											
	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Survey design																		
Survey rounds																		
Outreach and capacity building workshops																		

	2012											
	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Survey design												
Survey rounds												
Outreach and capacity building workshops												

Investigators

The Ministry of Agriculture of Ecuador is developing a new strategy, shifting the concentration of its policies from export agriculture to family farming in order to address rural poverty. This is based on the facts that around 82% of the rural population suffer from unsatisfied basic needs and that even though 78% of rural households have some income from agriculture 82% of the rural population is underemployed. A highly unequal land distribution (Gini coefficient for land is 0.81) and low productivity of small farms are the main causes of this situation. The Ministry is engaging in the insurance program described above as part of its rural development strategy.

The Escuela Superior Politecnica del Litoral (ESPOL) is one of the leading research institutions working on rural development in Ecuador. ESPOL’s Center for Rural Research (housed in the Department of Mechanical and Production Engineering) has significant experience working on rural financial markets and is currently working with a microcredit fund linked to the adoption of improved technology for rice production areas in the provinces of Guayas, Los Rios and Cotopaxi , areas in which the government will be implementing its pilot insurance program. In addition, ESPOL has been working with the Ministry of Agriculture through an agreement for the elaboration of rural development related studies, which will facilitate collaboration for this project.

The collaborators from UC-Davis are co-directors of the Index Insurance Innovation Initiative (*I4*) and are thus uniquely qualified to contribute to this project. Housed at the University of California, Davis, the *I4* is a joint venture of the BASIS Collaborative Research Support Program, the United States Agency for International Development, the Food and Agriculture Organization of the United Nations, the Micro-Insurance Innovation Facility of the International Labour Organization, and OXFAM America. The initiative is a response to the overwhelming evidence that uninsured risk can create and sustain poverty and food insecurity, especially amongst low-wealth agricultural and pastoralist households. While index insurance would seem to be an ideal instrument for transferring risk from smallholder households (as it promises low transaction costs and minimal problems of adverse selection and moral hazard), its viability and poverty reduction impacts have yet to be demonstrated. The goal of the *I4* is to discover whether, when and how these impacts can be realized and sustained. While it operates primarily as a virtual research center, the *I4* brings together top, innovative researchers so that ideas on design, implementation and impact can be shared and brought to scale.

Budget

The total budget requested from Ford for Phase I is \$287,035. This will be matched with \$112,000 funds from other sources. The matching funds will primarily be used to support a University of California Ph.D. student to participate in the project over all phases, including study design, data collection and final analysis.

Except for travel funds, the funds requested from Ford will be used to cover data collection costs in Ecuador, as well as salary costs for researchers at ESPOL. We will subcontract these funds from UC to ESPOL. A full breakdown of the budget is given in the attached budget spreadsheets accompanying this document.