Selling Formal Insurance to the Informally Insured

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Abstract

Farmers face enormous production risks due to unpredictable rainfall, yet most do not have any formal insurance. One explanation for this is the existence of informal network-based risk sharing. Using a randomized controlled experiment, we study the demand for, and effects of, offering formal index-based rainfall insurance in an environment of tightly knit informal risk sharing networks: sub-castes in rural India. We partner with the Agricultural Insurance Company of India (AICI) to market a new insurance product to farmers for whom we have a rich history of their sub-caste's responsiveness to household and aggregate rainfall shocks. Our first rounds of data collection have shown that (a) When formal insurance carries basis risk, informal risk sharing covering idiosyncratic losses enhances the benefits of index insurance, and (b) Formal index insurance enables households to take more (potentially profitable) risk even in the presence of informal insurance. We are seeking funds to conduct an additional round of data collection to understand the spillover effects of index insurance on other members of risk sharing networks. We plan to market the insurance product to both the original set of households and to households connected to the original set by their sub-caste identity and their village location.

Total Project Budget = $682,502.44 (for whole project encompassing first and second rounds)

Funds Requested from BASIS = $253,529.09

I Introduction

Nearly three-fourths of the 1.3 billion people worldwide living on less than US$1 per day depend on agriculture for their livelihoods (World Bank, 2005). This activity is inherently prone to natural shocks: Parchure (2002) estimates that in India about 90% of variation in crop production is caused by changes in rainfall levels. As Rosenzweig and Binswanger (1993) have shown, low income farmers in areas of high agricultural risk tend to invest in assets that are less sensitive to variation, but are also less profitable. This exacerbates pre-existing wealth inequality (as wealthier farmers are more able to make profitable investments) and reduces the possibilities for growth.

The research project proposed here seeks to understand why Indian farmers exposed to weather-based risk may be reluctant to purchase formal insurance products that mitigate those risks. Our approach takes advantage of exogenous natural variation in informal insurance among Indian farmers (based on their membership in a sub-caste-based risk-sharing network), with designed (randomized) variation in the insurance contract offered. The randomized design component of the project will help identify the causal effects of liquidity (or credit or savings) constraints in explaining low take-up rates. On the other hand, marketing to farmers from different sub-castes or *jatis* who are differentially indemnified through their informal risk-sharing networks will help identify whether farmers are reluctant to purchase formal insurance contracts simply because they are already informally insured. We have conducted two round of data collection on this topic, and have produced some outputs (e.g. see http://faculty.som.yale.edu/mushfiqmobarak/insurance.pdf). We are requesting funds to conduct an additional round that will generate new evidence on the spillover effects of formal insurance on other members of the informal risk sharing network.

II Background

Ninety percent of the Indian population is not covered by any kind of formal insurance (Mukherjee, 2010). Experts hypothesize that various frictions such as information asymmetries, contract

enforcement costs and fraud prevent formal credit and insurance markets from being established (Rothschild & Stiglitz, 1976; Finkelstein & McGarry, 2005). Moreover, high transaction costs and covariate risk due to catastrophic events affecting large geographic areas make provision of traditional insurance prohibitively expensive (Barnett et al., 2008).

In recent years, the emergence of index-based risk transfer products (IBRTPs) has sparked a great deal of interest among development researchers and practitioners as a possible solution to some of these concerns (Hazell et al., 2010). Rainfall index-based insurance is a financial product where payments are conditional on publically observable measures of rainfall over a specified period of time. In theory, an optimally designed weather index-based insurance product can address many of the moral hazard and adverse selection problems common to insurance schemes that indemnify individual losses. It also eliminates the need for in-field assessments, thereby lowering the cost to the insurance providers. Providing index-based insurance to low income farmers therefore has the potential to reduce underinvestment in agricultural technology, and increase productivity even among risk averse individuals (Barnett et al., 2008).

Agriculture accounts for around 18% of India's gross domestic product, and in 2010 an estimated 51% of the population was employed in agriculture (World Bank, 2012). Most of the agricultural production is small-scale: of more than 120 million landowners, 80% own parcels of less than 2 hectares (Barnett & Mahul, 2007). Agriculture in India is mostly rain-dependent, with only 35 percent of total agricultural land being irrigated (World Bank, 2012). This has always been risky, but climate change and increasing pressure on natural resources from the growing population are increasingly compounding the problem of lack of irrigation facilities. Monsoon rains, which provide 80% of India's precipitation, have been the scantiest in decades. Worse yet, scientists predict that these rains will become even more contracted and unpredictable in the near future. The main rivers of the Indian subcontinent are predicted to receive less water during the summer time due to the rapid melting of Himalayan glaciers – which implies prolonged dry seasons and more violent wet seasons.

These factors are likely to exacerbate the variability of agricultural production and uncertainty across the entire crop cycle (When the Rains Fail 2009).

The government of India has recently begun promoting index-based weather insurance as a way of mitigating the economic impacts of unpredictable monsoons and climate change. Two private insurers, ICICI Lombard General Insurance Company and IFFCO Tokio General Insurance Company, currently offer index-based insurance (Hazell et al., 2010). The government also funds the Agriculture Insurance Company of India (AIC), a public company offering several indexed insurance products. In an attempt to boost demand for weather insurance among farmers, the government of India has allowed public and private index insurance programs to take advantage of subsidies, making the premium more affordable.

Despite the strong government support, take up rates for index-based insurance products have been surprisingly low, even when actuarially-fair rainfall insurance contracts are offered (Cole et al., forthcoming). This observation poses a puzzle: if insurance products truly have the potential to improve outcomes for low-income farmers, why do we not see greater interest in these products?
Previous marketing experiments have explored several constraints limiting the widespread adoption of insurance products in developing countries, including liquidity constraints, contract complexity, trust, and limited liability credit (Giné et al., 2007; Cai et al., 2009; Giné & Yang, 2009; Cole et al., forthcoming). Cole et al. (forthcoming) offer rainfall insurance to farmers in three Indian states and find that households who were randomly assigned to receive a positive liquidity shock and those who have previous experience with insurance have a greater likelihood of insurance purchase. In a closely related paper, Giné et al. (2007) find that insurance take-up is higher among wealthy households and lower among households that are credit constrained. Other studies have explored behavioral constraints to insurance take-up, including mistrust in the insurance policy and insufficient understanding of the product itself (Gaugav et al., 2011; Cole et al., forthcoming). Farmers with high levels of basis risk (i.e., a mismatch between the index-based payouts from the insurance product and the policy holder's actual

loss, most often due to differences in rainfall by region that widely scattered rainfall monitors are not able to pick up) may perceive the insurance product to be poorly designed (Clarke, 2011).

Another long-standing hypothesis explaining thin formal insurance markets in poor populations is that pre-existing informal risk-sharing arrangements either reduce the demand for formal insurance or prevent formal markets from being established. Indeed, there is a large literature documenting the mechanisms of informal risk-sharing schemes among rural populations in poor countries, and especially in India (Ravallion & Dearden, 1988; Rosenzweig, 1988; Rosenzweig & Stark, 1989; Townsend, 1994; Mazzocco & Saini, 2012). However, studies generally find that risk-sharing is incomplete, which in turn leads exposed farmers to choose low risk and lower-yield production methods, asset portfolios, and crops, instead of riskier but more profitable alternatives (Rosenzweig & Binswanger, 1993; Carter & Barrett, 2006). The potential welfare effects from high uninsured risk exposure may be devastating, leading to the depletion of assets and the creation of a poverty trap (Barnett et al., 2008).

In rural India, a system of informal mutual insurance has historically formed around the sub-caste system, called *jati*. Munshi and Rosenzweig (2005) argue that caste-based networks in India are persistent and have survived for centuries precisely because they help to smooth consumption and are effective in overcoming information asymmetries and enforcement problems. Consumption within a *jati* can be smoothed via a simple mutual insurance arrangement with limited commitment. Households that receive a negative income shock receive financial support from relatives and other members of their *jati* who have fairly accurate and easily verifiable information about that income shock. Other *jati* members are willing to help because they know that, in the case of an adverse event in the future, the household will reciprocate by providing the same support to them. Those that renege on their obligation can be sanctioned by losing network and financial support in the future. In fact, Munshi and Rosenzweig (2009a) show that such quasi-loans play a more important role in managing income and consumption variability than other common risk management alternatives, such as bank or moneylender credit, pure gifts or government transfers. Mazzocco and Saini (2012) also highlight the importance of caste-based

networks. Because adverse natural events can affect whole villages at at time, *jati* networks that span multiple villages and districts are important in insuring risk across a broader geographic area.

However, caste-based insurance may not be complete due to limited enforcement, hidden income (Kinnan 2010), or exogenous changes to the wealth distribution that incentivizes those becoming richer to leave the network (K. Munshi & Rosenzweig, 2005; K. Munshi, 2005). Caste-based networks may hinder economic development if the norms of risk-sharing prevent households from making productive decisions and investments (K. Munshi & Rosenzweig, 2009b).

III Research and Experimental Design

Our study seeks to add to the literature on the market for insurance products by generating rigorous evidence on the relationships between informal risk-sharing, basis risk and the demand for formal insurance. In spite of the large prior literature on the importance of informal risk-sharing in developing countries, our study is the first (to the best of our knowledge) to empirically explore how informal risk sharing affects the provision of and the demand for formal insurance. Our empirical approach and dataset are unique: we make (randomized) offers of a formal rainfall index insurance product to about 5100 agrarian households. The households receiving these offers were carefully chosen from a sample of 100,000 households for whom we had detailed long-term panel data about their *jati* membership, and the history of both aggregate (e.g. drought) and idiosyncratic (e.g. illness) shocks faced, as well as informal gifts and loans exchanged in response to the shocks. We therefore know the pre-existing level of informal indemnification for each of our respondents, and can match this to their response to offers of formal index insurance designed and sold by our partner, the Agricultural Insurance Company of India, Ltd. (AICI). This combination allows us to generate rigorous evidence on (a) the effects of informal risk sharing on formal insurance demand, and (b) the effects of informal and formal indemnification on risk taking by farmers.

This proposal seeks funding to complete a second round of intervention and data collection activities with the sample of households who were part of the project begun in 2010. We had originally raised GBP 119,000 (~US$190,000) from the DFID/LSE *International Growth Centre* (IGC) for the first round of the project, and have subsequently raised GBP 70,000 plus US$14,000 for the second round from IGC and from Yale University Macmillan Center (a total of roughly US$119,000). We are seeking a USAID/BASIS grant to augment this US$119,000 in funding, so that we can complete data collection activities and analysis for the second round. In this round we will focus on a variety of spillover effects of formal index insurance on other *jati* members, and on other activities of the insured. Do people who belong in a risk sharing network with a person who purchased formal insurance benefit in any way (e.g. through increased transfers from the insured)? Do they become more or less likely to purchase insurance in a second round, conditional on their friend's experience? Does the insured engage in other risky (but potentially high return) behaviors in the longer run, such as seasonal migration in search of employment and higher wages? In summary, a further round of data collection using USAID/BASIS funds will allow a richer and more complete characterization of the complex set of interactions between informal risk sharing and formal index insurance markets.

III. A) Description of First Round Activities and Research Findings

In late 2010 through early 2011, we marketed and sold rainfall insurance to 5,100 household across 63 villages in the Indian states of Uttar Pradesh, Andhra Pradesh, and Tamil Nadu. These households were randomly chosen from among households who participated in the listing exercise in the 2006 Rural Economic Development Survey (REDS)[1]. This survey contains information on the landholdings, education, income and occupation of each respondent, as well as data on their *jati* or sub-caste membership. Using these data, we are able to characterize the *jatis* in terms of the extent to which they

[1] The recently completed sixth round of the national NACER REDS panel survey, designed and financed by Andrew Foster and Mark Rosenzweig, collected information on all households in 242 villages in the 17 major states of India — over 116,000 rural households, about three-quarters of whom are farmers.

informally indemnify aggregate and idiosyncratic risks faced by members. For our sample of 5100 households, we can thus examine a particular household's insurance demand as a function of both their personal characteristics (income, education, risk aversion, and randomly assigned prices faced), as well as *jati*-level indemnification, which are functions of aggregated wealth, diversification, geographic spread, and occupational attributes.

One of the PIs for this grant application, Mr. Kolli Rao, designed the rainfall insurance product with the help of his staff at the Agricultural Insurance Company of India, Ltd. (AICI). We randomly selected 42 villages to receive insurance marketing, while 21 other villages formed the control group. AICI agents visited households to market the product. The randomized interventions were as follows:

- **Price Variation**: We experimentally varied the price of the insurance contract through on-the-spot lotteries at each household. Households received discounts of either 0, 10, 50, and 75%.

- **Marketing Techniques.** Each household was randomly assigned to receive either a standard insurance marketing script (the "Normal" script) or a script that treated the insurance product as though it was a gamble (the "Gamble" script). Households were then further randomized to receive one or both of the following pieces of information in addition to the marketing script: (i) the historical rainfall distribution data that was used to compute the insurance premium ("historic" script); (ii) households were told that the insurance product would also be available next year (the "Return" script). The distribution of households receiving each type of script is shown in the table below.

	Tamil Nadu		Andhra Pradesh		Uttar Pradesh		Total	
Type of Marketing Script	N	Share	N	Share	N	Share	N	Share
Gamble	173	19.6%	366	18.5%	240	13.7%	779	16.9%
Gamble + Historic	138	15.7%	158	8.0%	111	6.3%	407	8.8%
Gamble + Return	52	5.9%	154	7.8%	140	8.0%	346	7.5%
Gamble + Historic + Return	65	7.4%	330	16.7%	255	14.5%	650	14.1%
Normal	148	16.8%	431	21.8%	362	20.6%	941	20.4%
Normal + Historic	157	17.8%	137	6.9%	155	8.8%	449	9.7%
Normal + Return	65	7.4%	137	6.9%	178	10.1%	380	8.2%
Normal + Historic +Return	83	9.4%	261	13.2%	317	18.0%	661	14.3%
Total	881	100%	1974	100%	1758	100%	4613*	100%

* This number is lower than the total sample size of 5100 due to the fact that many households from the REDS data could not be located

- **Installation of Automatic Weather Stations**

We randomly varied the locations of new rainfall stations that we had to install in order to study the importance of basis risk in explaining the low demand for formal insurance. Basis risk is the potential mismatch between the rainfall index-based payouts and the actual losses incurred by the policy holder, which is more likely to occur if the weather station is located far from the policy-holder's farm. In Uttar Pradesh, we partnered with National Collateral Management Services Limited to install 19 Automatic Weather Stations (AWS), with 12 of them placed inside 12 (randomly chosen) villages where insurance policies were being marketed, and 7 placed in the usual central location in the district, which falls outside any sample village. We informed farmers of the locations of the nearest AWS during our insurance marketing, which allows us to study the effects of perceived basis risk.

With our first round of funding from IGC, we conducted baseline surveys with all participants. In addition, we conducted village meetings in all treatment villages in order to release the payout details from the 2010 insurance product to the whole village, ensuring transparency regarding the conditions for payments. With the second round of funding, we have conducted follow-up surveys, and (conditional on receiving USAID/BASIS funding) plan to conduct one more round of insurance marketing and data collection. The timeline for the field activities completed to date:

	2010				2011												2012		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Tamil Nadu	Baseline							Follow-up											
	Intervention						Village Meetings												
		Monsoon																	
Andhra Pradesh		Baseline														Follow-up			
					Intervention														
									Monsoon										
Uttar Pradesh		Baseline															Follow-up		
					Intervention														
									Monsoon										

The research activities to date have generated several important results:

- Providing access to formal rainfall insurance helps rural households to gain financial stability by raising average income and allows them to shift to a *higher-yield, more risky* production strategies, which is a key ingredient for growth. Offer of formal index insurance increases risk-taking, even when farmers already had informal risk-sharing mechanisms available to them through *jatis*.
- Informal risk-sharing networks *reduce* risk-taking and thus average incomes.
- Landless laborers, who constitute the poorest segment of the rural population, and are often excluded from formal financial services, exhibit substantial demand for rainfall insurance. This finding underscores an important advantage of index-based insurance (over crop insurance, for instance) related to equity considerations, because rainfall insurance can offer a risk-coping strategy and it benefits to a larger number of people.
- Basis risk is a significant impediment to the take-up of the index insurance product. We find that households more distant from rainfall stations (which was randomly assigned due to our AWS installation experiment) are less likely to purchase insurance contract.
- Households are very responsive to (randomly) assigned price subsidies. Specifically, we found that a 50% subsidy increases probability of take-up by 17.6 percentage points.

III. B) Research Questions to be addressed in a Second Round with USAID/BASIS funds

We seek USAID/BASIS funds to complete a second round of insurance marketing, and an associated household survey at all treatment and control villages where we have already collected data. The new round of insurance marketing offers will be targeted to both our original households (sample size of approximate 4500, accounting for possible attrition), as well as some new households who are in informal risk sharing networks with the original first-round treatment households (expected sample size of 2000). This strategy will allow us to track a variety of spillover effects, and study the complex relationships between informal risk sharing and formal insurance markets. Please see below some examples of specific research questions we will be able to address with this strategy:

1. Experience: How does variation in experience with insurance products affect the demand for insurance and investment behavior in a subsequent year? In our first round, treatment households were offered insurance, and a subset chose to purchase. We know their purchase decisions, and their subsequent experiences (e.g. whether a payout occurred). The second round of marketing will allow us to study how the direct experience with an insurance product influences the decision to purchase insurance in subsequent years, and whether this has any impact on longer-run investment choices. Any study of the demand for insurance must take into account how the history of payouts affects demand.
2. Spillover effects: Does an insurance purchase have spillover effects on members of the same *jati* who do not have insurance? If, among members of the same *jati,* some people receive insurance payouts, the benefits may spill over to uninsured members through in-kind or monetary transfers. We will collect data on gifts and loans to monitor spillovers. The finding of spillovers is important because it suggests not only that insurance take-up is a group decision, with implications for marketing, but also that there may be lower take-up than is

optimal because of free-riding. That in turn may create an efficiency-based motivation for subsidizing insurance.

3. Network effects: How does knowing someone with insurance affect one's likelihood of purchasing insurance? Our first round of marketing has created random variation in exposure to insurance among all villagers, including those who were not offered the product in the first round. We know the *jati* identity, and can therefore track the depth of exposure. We can also combine this with data on whether first round households received a payout from the insurance product, and whether this positive income shock has an additional effect on uptake rates among risk-sharing network members in the second round. These learning spillovers also have important implications for optimally providing insurance. Note again that our data are unique in exploiting the well-defined and exogenous informal group boundaries defined by sub-caste in India thus permitting attention to group effects.
4. Repeat sales: What is the effect of announcing that the insurance product will be offered again? In our prior round of experiments, we announced to a random subset of households that we would return to sell insurance again. In theory, households expecting to have access to insurance over multiple periods should be more willing to undertake risky investments that involve longer-run changes in production technology. By making a repeat insurance offer to the same household, and by collecting an additional round of data, we can document whether such long-run behavioral changes occur among farmers. One major deficiency of prior insurance RCT's is that they do not correspond to any real-world insurance program, which lasts more than one period. Such studies may severely underestimate the impact of insurance provision on profitability.
5. Effects on other behavior: Does having access to agricultural insurance encourage people to engage in other risky but potentially profitable experiments, such as migrating in search of employment? In theory, if the risk of a negative shock due to crop failures is effectively

eliminated, this could free up household assets (which would otherwise be saved to smooth consumption in the case of a shock) to invest in other risky but potentially profitable activities. A second round of data collection will allow us to see if, in the longer term, households do in fact shift their investments in this way.

IV. Design and Sampling

In this second round of interventions, we plan to offer an index-based rainfall insurance product similar to the one we previously sold to insure agrarian households in advance of the 2013 monsoon season. The product will again be developed in collaboration with the Agricultural Insurance Company of India. AICI local offices and marketing affiliates (with whom we have an established relationship) will then market the product in the project villages.

The rainfall insurance policy we will offer is an example of a "Delayed Monsoon Onset" index-based insurance product, which insures against agricultural losses due to delayed rainfall during the summer monsoon season. First, AICI will define an expected onset date of the summer monsoon using historic rainfall data. The monsoon onset is defined as a certain level of rainfall accumulation as measured by the block-level Automatic Weather Station (AWS). The onset date is considered delayed if the target amount of rainfall is not reached by one of three pre-selected "trigger" or payout dates. Unit prices for the insurance will vary across 'blocks' – small geographic areas – depending on the rainfall risk as assessed by AICI. In our previous round, we had three trigger dates: the first (Rs.300) payout came if the monsoon was between 15-20 days late; a larger (Rs.750) payout came if the monsoon was 20-30 days late; and the largest (Rs. 1200) came if the monsoon was between 25 and 40 days late. AICI will determine the specifics of product pricing and payout for this round based on actuarial calculations. The insurance policy will not be crop specific, thus providing broad coverage for monsoon onset. In addition, since a large share of the sample is comprised of landless agricultural laborers, purchasing units will be independent of the land holdings of the buyer.

Of the three states in which we marketed insurance products in the first round, only in Andhra Pradesh was monsoon-delayed, resulting in payouts to policy holders. Thus initiating another round of insurance sales and data collection in this state will allow us to examine the effect of payouts received by insurance purchasers on their current demand for insurance, as well as on the demand of other households living in the same villages or belonging to the same sub-castes. Our sample will include the following types of households:

1. Group A: Households from the treatment villages who were (randomly) selected to receive an insurance offer in round 1.
2. Group B: Households from the same villages and the same *jati* as Group A. These households did not receive an insurance offer in round 1.
3. Group C: Households from the same villages but a different *jati* as Group A. These households also did not receive an insurance offer in round 1.
4. Group D: Households from different (control) villages, but the same *jati* as Group A.

Group B and C households can be drawn from both our existing sample (although some of those will be retained as controls), and by drawing on a new sample. The set up will allow us to track spillovers both across *jati* and across villages, in order to better identify the relevant risk sharing network in India. The rainfall insurance experiment will involve household-level random assignment of insurance premium discounts. Our randomized price treatment will feature a single price discount (at 50%), randomly allocated based on each individual's lottery pick (or by flipping a coin).

Prior to the start of the cropping season we will conduct a marketing visit to all the households in our sample. Marketing visits will be carried out by an experienced team of marketers from the Center for Micro Finance, trained by the local AICI officers. Marketers and a field monitor will visit each household and offer the insurance policy. If the household refuses to make a purchasing decision during the first visit, then the team will return for the second visit a week later. Households will be given

between 10 to 20 days to secure the cash to pay for the insurance product, and the marketer will revisit the household after that period to collect the premiums.

Following the marketing visits, insurance payouts will occur over the 4-month monsoon period. An advantage of designing a product based on monsoon onset is that payouts can occur earlier during the agricultural season when farmers need money more than after their harvest. We already have demographic data on all households (from our baseline survey), information on insurance purchase decisions and payouts for Group A, and on reciprocity-based financial assistance (net transfers) since January 2011 (from our first follow-up survey) for all households in our existing sample. After the monsoon is over, we will conduct a second follow-up survey with all households in the second round sample. In addition to measures of income, consumption smoothing, investment decisions, risk-taking (e.g. migration), transfers and loans, this survey will include qualitative data on:

1. Perceptions of rainfall on plots during the last monsoon season in 2011. Farmers may be disgruntled with the insurance policy and discouraged from purchasing it again if rainfall at policy holders' plots deviates significantly from measures at the weather stations (i.e., there is basis risk). We have previously demonstrated that basis risk is an important impediment to the take-up of formal insurance, and using perception-based measures will allow us to re-visit this question.
2. Household's subjective opinion about whether they thought they deserved a payout (only Group A) and understanding of the insurance policy (all groups). One of the prevailing explanations for low demand for formal insurance is lack of trust in or lack of understanding of the insurance product.
3. Transfers, informal loans and gift exchanges made in the last year to and from friends/relatives belonging to same/different jati and living in the same/different village. This data will allow us to examine how the benefits of indemnification from insurance—in case of the payouts or through increase in the average incomes of insurance purchasers—

are shared within and across villages and sub-caste-based networks and how they affect welfare.

Combining these data with new information on insurance purchase decisions, we will create a panel data set which will allow us to investigate in more depth the determinants of insurance take-up.

V. Policy Relevance and Links to USAID Objectives and BASIS Themes

The findings from this research project will be of interest to policy makers, donors and stakeholders in the developing world who are interested in developing financial services to serve the risk management needs of the rural poor. Index-based weather insurance is potentially a promising tool for addressing the systematic threats to agricultural production posed by extreme weather events. However, prior to investing scarce resources in IBRTPs, it is necessary to generate rigorous evidence on both the advantages and limitations of this insurance instrument, and on how it *interacts* with pre-existing systems of informal risk management. Our first round results have already shown that farmers switch to riskier, *higher-yielding* crops from drought-resistant crops after the formal insurance product is offered to them, indicating that index-based insurance may be a cost-effective and viable policy response to address this major constraint to growth, even in the presence of well-developed pre-existing informal risk-sharing networks. The further analysis we intend to conduct with second round data will allow us to track how formal insurance in turn affects the informal relationships, and will generate evidence on demand at the group level, accounting for demand spillovers.

The goals of our proposed project are closely aligned with the core food security and agricultural development objectives of USAID, specifically the U.S. Government's global hunger and food security initiative, **Feed the Future**, since the insurance product we are marketing has already been shown (using rigorous, RCT-based evidence) to increase the use of riskier, higher-yield crops by Indian farmers. The project will also advance one of **USAID/India's** key objectives – "to [adapt] technological advances and

innovative solutions to address agricultural and food security concerns in India and around the globe." High dependency on rainfall for irrigation in rural India leads to income fluctuations and food vulnerability among agriculture-dependent households. Even small changes in the intensity, frequency and timing of rainfall can have a devastating effect on agricultural yields and food security in the entire community (United States Agency for International Development, 2012). Rainfall insurance can help households smooth consumption and improve food security in times of low agricultural output, without resorting to costly ex-post risk-management strategies such as selling assets. This has the potential to help families escape the poverty trap generated by underinvestment in profitable agricultural technologies due to risk aversion (Bryan et al., 2010)

The topic of our proposed research is directly related to the research priorities set out by the **BASIS I4 Index Insurance Innovation Initiative**. These priorities include developing viable and sustainable risk transfer mechanisms to reduce uninsured risk among low-income households. If funded, our project will design, implement and rigorously test the effects of an innovative rainfall index-based insurance product. We will also contribute to the understanding of the market for such products by providing an in-depth analysis of the determinants of take up. The key innovation of our study is our analysis of demand and consequences in the context of the informal risk sharing networks that traditionally performs some of the same functions that index insurance is intended to provide.

The existing literature has documented some unwillingness among the poor to experiment with new technologies and financial products in agriculture (Giné & Yang, 2009; Duflo et al., 2011). Technology adoption studies generally maintain that risk-averse poor households are the least likely to adopt new technologies, despite high returns (Giné et al., 2007; Lybbert et al., 2010). Our study contributes to this literature by looking closely at the following determinants of insurance take up:

1. Product design: Our first round of experiments showed that detaching insurance from specific crops and from individual land-holdings allowed landless laborers to take advantage of the product. This finding suggests that groups who have traditionally been excluded from the

formal insurance market can benefit greatly by gaining access to the formal index-insurance and insuring against weather-related risk that affects their employment opportunities and earnings.

2. Basis risk: We have exogenous variation in distance from the rainfall station in some villages, which permits rigorous evaluation of the effects of basis risk on insurance demand. With USAID/BASIS funds, we will collect qualitative data on peoples' perceived basis risk, which will add nuance to our understanding of the impact of basis risk.

3. Pricing and Liquidity constraints: Liquidity constraints may be an important barrier to take-up of formal insurance because the insurance premium typically has to be paid at the start of the monsoon season when farmers have little cash holdings. With our price experiments, if we discover that liquidity constraints have significant causal effect on insurance take-up, several policy responses may be considered, such as (a) adjusting the timing of insurance marketing and sales activities to better accommodate liquidity-constrained households; or (b) bundling index-based insurance products with microcredit products and services.

4. Informal insurance through networks: Our key contribution to the literature on indemnification is our ability to empirically assess the impacts of the interaction between informal, caste-based insurance and a formal insurance contract. Our first round results indicate that there may in fact be complementarities between the two, as formal insurance can reduce aggregate loss, while the caste-based insurance covers idiosyncratic losses. In the new round we can further examine how within-network connections affect individual take-up through learning from others and via intra-caste transfers of benefits.

5. Trust and understanding of the insurance product: New financial technologies, like all innovations, are often slow to be adopted when beneficiaries don't fully understand how they work or trust that they will be beneficial. An extensive body of literature in sociology, marketing, and economics has documented the impact of knowing others who have adopted the technology on one's own adoption decision (See Rogers, 2003 for a summary of diffusion

research to date). Our research contributes to this literature by empirically estimating the demand effects of knowing someone – either within one's village or within one's *jati* – who has previously purchased an indexed insurance product.

Our research also contributes to a growing body of research on the effects of insurance on household welfare and overall productivity by generating rigorous evidence on changes in income, assets, consumption, and investment decisions at the household and individual level.

VI. Collaboration, Capacity building and Knowledge Sharing

A senior staff member of the Agricultural Insurance Company of India, Ltd., which is a Government of India-sponsored enterprise, is a PI on this research team. Governments are more attuned to research results when they are themselves involved in the production of that research, and we are therefore confident that with this research team composition, our results will have policy effects, or at least generate immediate lessons that get heard by the right people and subsequently enter the policy discourse. This collaboration will also help AICI better design their products to more effectively meet the needs of the rural poor. We are collecting data on investment choices and agricultural profits to more directly and fully understand the development impacts of this project.

We are not only producing academic articles and presenting them in key academic conferences, but we are also producing policy briefs using language and formats that are easily accessible to policy-makers in India: (e.g. see http://weatherinsurance.wordpress.com/research-intr/selling-formal-insurance-to-the-informally-insured-in-india/). We will use our existing connections with the International Growth Centre (IGC) in London, Institute for Financial Management and Research in Chennai, India, and with Innovations for Poverty Action (New Haven, USA) and the Jameel Poverty Action Lab (Cambridge, USA and Delhi, India) to widely disseminate results, as we have done with the first round of the project. These organizations have extended networks of researchers, donors, and

practitioners, and regularly publish research results in venues that are accessible to those without technical knowledge. The first round of our project is already featured in the websites of each of these organizations. We have also presented our academic paper at the IGC India Growth Policy Conference (New Delhi, 2011), and at the I4 Index Insurance Conference (Rome, 2012).

An important advantage of this proposal is that we are able to capitalize on the relationships and network connections cemented over the last 3 years during the implementation of the first insurance intervention. We have already established a close rapport with Agricultural Insurance Company of India (AICI), a pan-Indian public insurance company offering a variety of index insurance products. We chose AICI as a key partner during our first insurance intervention because of AICI's large operating scope and capacity throughout India, as well as its willingness to custom-tailor insurance contracts (as they have demonstrated by developing a new product for our research project). We hope that our research will contribute to the development of indexed insurance products that are more responsive to the needs of their target beneficiaries in terms of design, price, coverage, and timing of premium payments, so AICI's flexibility in this regard is useful for the research-policy interaction. Strategic partnership with AICI opens a host of opportunities for joint work with public, private, national and international stakeholders that have supported AICI and its work in the past, including Indian Meteorological Department, Risk Management Solutions India, and Karnataka State Disaster Monitoring Center, who provide expertise in historical weather patterns and product design.

We are also working closely with researchers from the Center for Microfinance (CMF). The Centre for Microfinance (CMF) at IFMR is an India-based independent research organization which specializes in issues related to financial access to the poor. The research team developed a partnership with CMF in late 2009 to complete two rounds of surveying and insurance marketing. CMF teams have developed tremendous field research capacity in the process, which we will leverage to create panel datasets with this new round of data collection that we are proposing.

IX. PIs' Qualifications

Dr. Mushfiq Mobarak is Associate Professor of Economics at the Yale School of Management, and a native of Bangladesh. He is involved in several randomized controlled trials in India and Bangladesh that aim to understand how to best encourage adoption of new welfare-improving technologies and behaviors. Most pertinent to this project are the randomized controlled trials he has run on migration, cook-stove and sanitation adoption in Bangladesh and India, and of course the first round of the rainfall insurance project described here. Mobarak co-chairs the Urban Services Initiative at the Jameel Poverty Action Lab (J-PAL) at MIT, and leads the Bangladesh Research Program for the 'International Growth Centre (IGC)' at LSE, and is heavily involved in policy dissemination of research in these capacities.

Kolli N. Rao serves as Chief Risk Officer and head of Product Development and Reinsurance for the Agricultural Insurance Company of India Ltd. (AICI). He has over 25 years of experience in the insurance field, and has offered technical expertise on projects with the World Bank, the Food & Agriculture Administration, the World Food Program, and the International Research Institute for Climate & Society. In addition, he has published technical papers and articles on agriculture and weather insurance, including a recent World Bank report, *Weather Based Crop Insurance in India*, coauthored with researchers from the University of Oxford and the World Bank (Clarke et al., 2012).

Professor Mark Rosenzweig is a world leader in the field of development economics. He has testified before Congress on the topic of immigration, and has published numerous articles and book chapters on risk, insurance and consumption smoothing behavior in rural areas of developing countries (see attached CV). He has extensive experience collecting data in rural India. He was the PI for the panel dataset Rural Economic Development Survey (REDS) in India, which serves as the sampling frame for this project.