SUPPORTING MATERIALS

Barriers to Household Risk Management: Evidence from India

Online Appendix [*]

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[*] This Appendix presents additional analyses and information relating to the paper "Barriers to Household Risk Management: Evidence from India."

Institutional Details Regarding Insurance Policies

Rainfall insurance policies are an example of a weather-based index product; this is simply an insurance contract in which the payout is determined as a function of a publicly observable and contractible index like rainfall, temperature or another climatic parameter.

One advantage of index insurance is that payouts can be calculated and disbursed quickly and automatically without the need for households to formally file a claim. In addition, index products are free of adverse selection and moral hazard because payouts are based only on publicly observed data rather than on private information reported by the beneficiary. These factors make insurance easier and cheaper to administer, in contrast to traditional indemnity insurance that covers actual losses and thus suffer from asymmetric information problems. On the other hand, index insurance may introduce basis risk, to the extent that the realization of the index is not perfectly correlated with the loss experienced by an individual policyholder.

Index insurance markets are expanding in many emerging market economies (World Bank, 2005; Skees, 2008). The first Indian rainfall insurance policies were developed by ICICI Lombard, a large general insurer, with technical support from the World Bank (Hess, 2003; Bryla and Syroka, 2007). There are many technical requirements and practical challenges in the design and implementation of a weather index insurance pilot. These are covered in detail in World Bank (2011). The ICICI Lombard product was piloted in 2003 in a semi-arid district of Andhra Pradesh. Over time, rainfall insurance has become more available across many parts of India, and policies are also now underwritten by competing firms, including the government company Agricultural Insurance Company of India (AIC).

Contract design. – Table 1 of the main text presents contract details for the 2006 insurance policies in Andhra Pradesh and the 2007 policies in Gujarat. Policies are underwritten by ICICI Lombard in Andhra Pradesh and by IFFCO-Tokio in Gujarat, though a Swiss reinsurance company provides re-insurance for ICICI Lombard. Payoffs are calculated based on measured rainfall at a nearby weather station maintained by the Indian Meteorological Department (IMD) or at an automated rain gauge operated by a private third-party vendor such as NCMSL.

ICICI Lombard policies divide the monsoon season, known as the "Kharif", into three contiguous phases of 35-45 days, corresponding to sowing, flowering, and harvest.[1,2] Separate policies are sold for each phase at a premium between Rs. 80 and Rs. 120 ($2-3 US).[3] A policy covering all three phases (column "Combined Premium") costs Rs. 260 to Rs. 340 ($6-8 US),

[1] Since monsoon onset varies across years, the start of the first phase is defined as the day in June when accumulated rainfall since June 1 exceeds 50mm. If <50mm of rain falls in June, the first phase begins automatically on July 1.
[2] The three phase ICICI Lombard contract was designed in 2004 in an attempt to simplify the initial 2003 contract. The 2003 product was based on an index that weighted each day differently to maximize the correlation between yields and rainfall. It was hard to market because it was difficult to understand. The 2004 payoff structure is based on crop models. Lack of rainfall is critical during planting and vegetative growth (Phases I and II), but yields are not much affected by lack of rainfall during the harvest (Phase III). However, excess rainfall during that period can destroy the harvest, and as a result, Phase III covers excess rainfall (World Bank 2011).
[3] As a point of reference, the average daily wage for agricultural laborers in our survey areas at the time of the study is around Rs. 50, although the incomes of landed farmers and more skilled workers are significantly higher.

including a Rs. 10 discount. IFFCO-Tokio policies are based on cumulative rainfall over the entire monsoon season (defined as June 1 to August 31) at government rainfall stations. Policy premiums are lower, between Rs. 44 and Rs. 86 ($1-2 US), reflecting a commitment to make policies accessible to even the poorest households. Households in both regions were free to purchase any whole number of policies as desired.

Each insurance contract specifies a threshold amount of rainfall, designed to approximate the minimum required for successful crop growth. As an example, the Phase I ICICI Lombard policy in Mahbubnagar pays zero when cumulative rainfall during the 35-day coverage phase exceeds the strike of 70mm. Payouts are then linear in the rainfall deficit relative to this threshold, jumping to Rs. 1000 when cumulative rainfall is below the exit of 10mm, meant to correspond approximately to a point of crop failure. Thus an Anantapur Phase I policy would pay Rs. 30 for a realized rainfall of 27 mm. IFFCO-Tokio policies have a similar structure, paying out whenever rainfall during the entire monsoon season is at least 40 percent below a specified average level for that district (normal rain).

The exception to this basic structure is the Phase III ICICI Lombard contracts, which cover the harvest, and pay off when rainfall is excessively high (rather than low), to insure against flood or excess rain that damages crops (see World Bank, 2011). The policies were designed by the insurance companies, in consultation with BASIX in AP and SEWA in Gujarat.

Marketing – Indian rainfall insurance underwriters do not generally sell insurance policies directly. Instead they use brokers, or partner with local financial institutions in each rural area, which have well-established networks for the provision of financial services to rural households.[4]

An important advantage of rainfall insurance is that payouts are calculated automatically by the insurer based on measured rainfall: households do not need to file a claim or provide proof of loss. This significantly reduces administrative expenses. Since all policies linked to a given rainfall station pay out the same amount, disbursal of payment is also relatively simple: the distributor (BASIX or SEWA) announces in advance it will visit a village, and pays all claimants in a single day. Any policy-members unable to collect their payments that day may collect them from the NGO subsequently.

Actuarial values, observed payouts and pricing. – For four policies in Table 1 of the main text, we calculate a simple measure of expected payouts, using historical rainfall data. Historical daily rainfall data is available from 1970-2006 for the Andhra Pradesh contracts, and from 1965-2003 for the Gujarat contracts. These data are not available for three Andhra Pradesh stations, where payouts are based on automated rain gauges, or for Anand in Gujarat.

Table 1 also reports the standard error of the expected payout. We note that individuals may have difficulty assessing the value of the policies because probabilities are often misjudged (Kahneman and Tversky, 1979 and Barseghyan, Molinari, O'Donoghue and Teitelbaum, 2011)

[4] Thanks to the 2005 Insurance Regulatory and Development Authority (IRDA) regulations, non-governmental organizations, microfinance institution and self-help groups are legally recognized as micro-insurance agents, thus increasing the potential for coverage (IRDA, 2005).

and because information about expected payouts and standard errors was not provided during marketing.

In addition, this simple method likely misstates the true value of the insurance policy, as it does not correctly measure the frequency of low-probability events. The distribution of insurance returns on ICICI Lombard rainfall insurance contracts is highly skewed. Analyzing a large sample of policies, Giné et al. (2007) show policy-holders obtain a positive return in only 11 percent of phases, and that the maximum return, observed in about 1 percent of phases, is 900 percent. Clarke et al. (2012) discuss insurance pricing in India in greater detail.

Using administrative data for all policies sold by BASIX in Andhra Pradesh from 2003 to 2009, Giné et al. (2012) find an average ratio of total insurance payouts to total premiums of 138 percent. The difference between this figure and our historical estimated return may reflect unusual shocks such as the severe drought of 2009. They may also reflect structural changes such as greater monsoon volatility (Goswami et al., 2006), although given the limited existing history of rainfall data and the skewness of the insurance return distribution, statistical tests of structural change are unlikely to be sufficiently powerful to detect changes.

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Online Appendix Table 1. Study Design, Andhra Pradesh

Visit	Village Endorsed	Individual Treatment			Sample Size
		Household Endorsed	Education Module	High Reward	
No	No	No	No	No	112
No	Yes	No	No	No	235
Yes	No	No	Yes	No	67
Yes	No	No	Yes	Yes	45
Yes	No	No	No	Yes	45
Yes	No	No	No	No	69
Yes	Yes	No	Yes	Yes	57
Yes	Yes	No	Yes	No	62
Yes	Yes	No	No	Yes	56
Yes	Yes	No	No	No	61
Yes	Yes	Yes	Yes	Yes	54
Yes	Yes	Yes	No	Yes	45
Yes	Yes	Yes	Yes	No	65
Yes	Yes	Yes	No	No	74
				Total sample	**1,047**

Notes. This table describes the experimental design for Andhra Pradesh in 2006. Study villages were first randomly assigned to two groups: those in which no endorsement visits would take place and those in which half of the visits would be endorsed. Households assigned a marketing visit in no-endorsement villages were randomly assigned one of four possible combinations of marketing treatments (education module x high reward), while households that received a marketing visit in endorsement villages were assigned one of eight possible combinations (endorsement x education module x high reward).

Online Appendix Table 2. Study Design, Gujarat

Group 1: Flyer Treatments				**Sample size**
Group	Individual/Group	Religion		
1A	Individual	Neutral		378
1B	Individual	Muslim		438
1C	Individual	Hindu		416
1D	Group	Neutral		368
1E	Group	Muslim		398
1F	Group	Hindu		393
			Total sample	**2,391**

Group 2: Video--Surveyed Respondents in New Treatment Villages				
Surveyed Households				**Sample size**
Group	Payouts	Frame		
2A	8/10 no	Safety		75
2B	8/10 no	Vulnerability		81
2C	2/10 yes	Safety		78
2D	2/10 yes	Vulnerability		81
			Total sample	**315**

Group 3: Video--Non-Surveyed Respondents in New Treatment Villages				
Group	Sew Brand	Peer / Authority	Payouts	
3A	Yes	Peer	8/10 no	124
3B	No	Peer	8/10 no	126
3C	Yes	Authority	8/10 no	150
3D	No	Authority	8/10 no	131
3E	Yes	Peer	2/10 yes	137
3F	No	Peer	2/10 yes	135
3G	Yes	Authority	2/10 yes	147
3H	No	Authority	2/10 yes	150
			Total sample	**1,100**
Discounts (All Video Households)				
D1	Rs. 5			566
D2	Rs. 10			566
D3	Rs. 20			283
			Total sample	**1,415**

Notes. This table describes the experimental design for Gujarat in 2007. Households in the 20 villages which were offered insurance for the first time in 2007 received video treatments. Households receiving video treatments that were in the original survey sample were shown one of four videos; other households were shown one of eight different videos. All households observing videos were offered a discount of either Rs. 5, 10, or 20 on their first policy. Households in the 30 villages where insurance was offered in both 2006 and 2007 were given one of six flyers.

Online Appendix Table 3. Binswanger Lotteries

Andhra Pradesh

Heads	Tails	ΔE / Δrisk	Percent choosing this lottery 2006
25	25	1.00	10.3%
20	60	0.75	25.6%
15	80	0.60	18.0%
10	95	0.50	25.3%
5	105	0.33	11.0%
0	110	0.00	9.9%
Average ΔE / Δrisk		0.57	

Gujarat

Heads	Tails	ΔE / Δrisk	Main Sample (N=1500)
25	25	1.00	14.0%
22	47	0.76	12.3%
20	60	0.73	15.4%
17	63	0.72	15.6%
15	75	0.71	9.3%
10	80	0.58	15.6%
5	95	0.45	7.9%
0	100	0	9.9%
Average ΔE / Δrisk		0.42	

Notes. This table describes the Binswanger Lotteries used to measure risk aversion amongst sample groups in Andhra Pradesh and Gujarat. Each respondent chose one of the listed lotteries, which increased in risk and expected value. Our measure of risk aversion assigns a value of 1 to those who choose the safe lottery and, for those who choose riskier lotteries, indicates the maximum rate at which they are revealed to accept additional risk (standard deviation) in return for higher expected return.