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Weather Insurance Savings Accounts

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Abstract

Better insurance against rainfall risk could improve the security of hundreds of millions of agricultural households around the world. However, customers have shown little demand for stand-alone insurance products. This paper theoretically and experimentally analyzes an innovative financial product called a Weather Insurance Savings Account (WISA), which combines savings and rainfall insurance. The paper uses a standard model of intertemporal insurance demand to study how customers' demand for a WISA varies with the amount of insurance offered.

A laboratory experiment is then used to elicit participants' valuations of pure insurance, pure savings, and intermediate WISA types. Contrary to the standard model, within-subjects comparisons show that many participants prefer both pure insurance and pure savings to any interior mixture of the two, suggesting that market demand for a WISA is likely to be low. Additional experimental and observational evidence distinguishes between several alternative explanations. One possibility that survives the additional tests is diminishing sensitivity to losses, as in prospect theory.

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1 Introduction

Although poor households can be especially vulnerable to risk, many are not well served by formal insurance markets (Morduch, 1994, 2006). Rainfall risk is of special concern since it is a covariate risk that cannot be well-insured informally. This paper theoretically motivates and experimentally evaluates an innovation for expanding protection against rainfall risk: linking rainfall index insurance with savings accounts.

Rainfall index insurance was developed to provide risk protection while also remaining affordable and accessible (Hess, 2004; Skees et al., 2001). A typical policy covers drought risk during the early and middle phases of the growing season and flood risk during the late and harvest phases, underwritten using data from government weather stations. Asymmetric information problems are avoided, and claims adjustment is unnecessary, because payouts depend only on measured rainfall. Despite high theoretical benefits (Cole et al., 2011, 2013), early trials have shown limited demand at market premiums (Giné and Yang, 2009; Karlan et al., 2010a; Giné et al., 2008; Cole et al., 2011, 2013).

By contrast, saving is ubiquitous among the poor. According to the World Bank's Global Financial Inclusion Database (Demirgüç-Kunt and Klapper, 2012), in 2010 over half of adults worldwide had an account at a formal financial institution, including 41% in developing economies and 24% even in countries with per capita income of $1005 or less. Informal saving and durable goods investment bring total savings participation rates higher still.

More pointedly, savings accounts with stochastic returns have shown promise in a number of contexts. Guillén and Tschoegl (2002) report in detail on the supply- and demand-side success of lottery-linked deposit accounts offered in Argentina, and Kearney et al. (2011) argue that positive skew in prize-linked savings account returns may effectively mobilize saving by low-income households.[1]

In this paper we explore whether bundling rainfall insurance with savings can overcome specific and general barriers to effective risk management (Cole et al.,

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[1]See also Tufano et al. (2011) and Cole et al. (2014).

2013; Kunreuther et al., 2013).[2] We introduce a Weather Insurance Savings Account (WISA), which combines features of a savings account with rainfall index insurance by indexing the return on savings to rainfall realizations. To fix ideas, denote the insurance share of the WISA by $\gamma \in [0, 1]$. Then $\gamma = 0$ implies pure savings, with a standard (non-rainfall-dependent) interest rate on savings, and $\gamma = 1$ implies pure insurance. Intermediate values of γ would provide returns equal to a linearly weighted average of the insurance payout and the regular interest earnings.[3]

We adapt an intertemporal insurance model to study demand for WISAs as a function of γ. The most important prediction from the model is that under the standard regularity conditions, demand as a function of γ cannot have a local minimim. Practically, this means that demand for a mixture of savings and insurance ($0 < \gamma < 1$) must be higher than demand for pure insurance ($\gamma = 1$), pure savings ($\gamma = 0$), or both. The model does not allow demand for a mixture of saving and insurance to be below demand of both pure products. We then present a laboratory experiment that tests this key prediction. As the experiment uses real products offered to real farmers, it also serves as a pilot for the WISA concept. Preferences for WISAs with a range of γ's were elicited using a Becker-DeGroot-Marschak (BDM) incentive compatible mechanism. We also measured risk and time preferences. Contrary to the model's central prediction, our within-subject design reveals many participants value both pure savings and pure insurance more highly than any interior mixture of the two. This preference for pure products is stronger for those with higher risk aversion.

We then evaluate three candidate alternatives to the standard model in an attempt to account for participants' puzzling preferences for both pure products over interior mixtures of them. First, farmers may value mixtures less because they are harder to understand than pure products. Experimentally, we manipulated whether

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[2]Bundling rainfall insurance with loans has previously been attempted. The Weather Based Crop Insurance Scheme (WBCIS) of The Agriculture Insurance Company of India (AICI) saw substantial rainfall index insurance coverage when it was a compulsory add-on to agricultural loans. Similarly, the NGO Microensure provides weather insurance exclusively tied to loans. In experiments by Giné and Yang (2009), requiring insurance as a loan add-on decreased demand for the loan.

[3]If the nominal interest rate on normal savings accounts is i, then nominal losses are possible in a WISA when $\gamma > \frac{i}{1+i}$.

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the WISAs were described as a (complicated) combination of insurance and savings, or (simply) an insurance policy with a guaranteed minimum payout. This manipulation made no difference, casting doubt on lack of understanding as a driver of the results. Second, we tested whether the results could be driven by farmers' expectation that they would be less likely to collect small payouts, which could make the savings/insurance mixtures less attractive. After the monsoon, we observed that farmers with higher payouts were not more likely to collect their experimental earnings than farmers with smaller payouts, making this explanation unlikely. Third, we consider the possibility that participants' choices over insurance are better explained by behavioral models (Richter et al., 2014; Ganderton et al., 2000). Prospect theoretic diminshing sensitivity (Kahneman and Tversky, 1979) implies consumers may not value small insurance payouts, as they view them as an insignificant contribution to a large loss. Therefore they would value savings/insurance mixtures less, as they provide insignificant amounts of insurance coverage. Our results are consistent with this extension to the baseline model.

The idea to combine insurance and savings is inspired by a few strands of literature, as well by observing various insurance markets. Slovic et al's (1997) insight that many people view insurance as a form of investment is supported by observations in the life insurance market (Gottlieb, 2013). Johnson et al. (1993) show that participants in a lab experiment prefer insurance with a rebate to that with a deductible. Anagol et al. (2013) advance the hypothesis that since customers underappreciate the importance of compounding returns, they may view insurance products that provide savings as offering higher returns than they actually do. As market-priced insurance generally gives a negative (risk-unadjusted) return on the invested premium, insurance is clearly a poor investment, and consumers who ignore the state-dependence of insurance payouts will tend to be dissatisfied with standard insurance products. If consumers do view insurance as an investment, then it may make sense to design insurance products that provide a positive payment in most states of the world.[4]

Consistent with results in the experimental literature, the private insurance marketplace provides some insurance products that guarantee a positive gross return

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[4]In lab settings, Connor (1996) finds evidence that consumers view insurance as an investment, while Schoemaker and Kunreuther (1979) document the opposite.

on the premium through policies that offer "no-claim refunds." With this type of insurance, policy holders receive part (or all) of their premium refunded to them if they do not make an insurance claim. One example common in developed countries is "whole life insurance," in which customers pay monthly premiums for life insurance but receive a lump sum of all the nominal premiums paid if they are still alive at a certain age. Customers pay extra for this service, and insurance companies earn returns on loadings and investment of the held premiums.

If people choose "no-claim refunds" policies, they show a preference for using insurance as a vehicle for savings. Similarly, many studies support the importance of the precautionary motive as a primary driver of saving (Karlan et al., 2010a; Rosenzweig, 2001; Fafchamps and Pender, 1997; Carroll and Samwick, 1997; Lusardi, 1998; Guiso et al., 1992). Despite the frequent usage of savings to protect against shocks, the rural poor are generally underinsured against large aggregate shocks such as droughts (Townsend, 1994). In a survey of farmers participating in a rainfall insurance pilot in Andhra Pradesh, 88% listed drought as the greatest risk they faced (Giné et al., 2008). If people are saving primarily to protect against shocks yet these savings are not enough to buffer against the most important risk they face, they might find a savings account with an insurance component especially attractive.

While to our knowledge there are no existing commercial products combining weather insurance with savings accounts, savings accounts offering other types of insurance do exist. In the 1990s the China Peoples' Insurance Company (CPIC) offered a savings account where customers received various types of insurance coverage instead of interest on savings (Morduch, 2006). Similarly, many banks and credit unions in developed economies offer savings accounts that confer modest auto or renters insurance as benefits. Savings accounts that offer some insurance in lieu of interest (such as the one offered by CPIC described above), and insurance policies offering "no-claim refunds" can be seen as lying along a spectrum between insurance and savings. The CPIC savings accounts are mostly savings, while the "no-claim refunds" policies are mostly insurance. Seemingly there would be scope for these mixtures in many insurance markets, including the nascent market for rainfall risk in developing countries. This paper's theory and experimental evidence suggest some caution: diminishing sensitivity in the loss domain may mean consumers prefer to

segregate decisions about savings from decisions about insurance.

This paper will proceed as follows. Section 2 introduces a simple insurance demand model to explain how people choose between savings and insurance, and to motivate the WISA concept. Section 3 outlines the experimental procedure and provides summary statistics about the participants. Section 4 presents the main experimental results, and Section 5 analyzes candidate explanations. We conclude in Section 6.

2 Optimal WISA Theory

In this section we introduce a simple model to study consumer decision-making about WISAs with varying insurance shares. In particular, to concentrate on the consumer's valuation of different WISA types, and to align with the experimental implementation discussed in the next section, we consider a scenario where a consumer receives a gift of a fixed amount of money invested in a WISA. We then analyze how the certainty equivalent of this gift varies with the WISA's insurance share and with the consumer's risk and time preferences. The model assumes plausibly that the consumer has access to savings but not rainfall insurance outside of the experiment.

2.1 Model Setup

We consider the two-period problem of a consumer who faces an uncertain negative shock $\tilde{x}$ in the second period. A standard savings instrument is available, in which an investment of s in the first period pays gross return $R > 1$. WISA investments consist of a mix of savings and insurance. The structure of the WISA is determined by $\gamma \in [0,1]$, which parameterizes the share of the WISA allocated to insurance. An investment of w in a WISA results in savings of $(1 - \gamma) w$ (with the same gross interest rate R as standard savings) and γw allocated to insurance. The insurance is standard proportional coinsurance as in Schlesinger (2000), where the premium is equal to the expected payout times $1 + \lambda$, with $\lambda > 0$ the loading factor. This

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means that for each rupee allocated to insurance, the customer receives a payout of $\frac{\tilde{x}}{(1+\lambda)E(\tilde{x})}$ in the event of income shock $\tilde{x}$.

Next, define the payout from the WISA as

$$g\left(w, \tilde{x}, \gamma\right) = \left(1 - \gamma\right) wR + \gamma w \frac{\tilde{x}}{\left(1 + \lambda\right) E\left(\tilde{x}\right)} \tag{1}$$

Full insurance is achieved when $\gamma w = (1 + \lambda) E(\tilde{x})$. Since γ is bounded above by 1, if $w < (1 + \lambda) E(\tilde{x})$ there is no WISA which provides full insurance. As described further below, our lab setup fixes w to isolate the effects of varying γ.

We assume that the consumer is endowed in the first period with income Y_1 and a WISA with insurance share γ and current face value of w. Savings s is chosen, $Y_1 - s$ is consumed, and first period utility is realized. In period 2, the shock arrives and the consumer receives $Y_2 - \tilde{x}$. Savings and the WISA yield Rs and $g\left(w, \tilde{x}, \gamma\right)$, respectively. All resources are consumed, and second period utility is realized.

We assume that utility U is time-separable, with period utility u globally continuous, thrice differentiable, and concave. Let the discount factor be β. Expected utility over the two periods is:

$$EU = u\left(Y_1 - s\right) + \beta E\left[u\left(Y_2 - \tilde{x} + Rs + g\left(w, \tilde{x}, \gamma\right)\right)\right] \tag{2}$$

The customer chooses savings s to maximize this expression. Indirect expected utility V, as a function of the endowments and the WISA payment function $g\left(w, \tilde{x}, \gamma\right)$, is defined as:

$$V\left(Y_1, g\left(w, \tilde{x}, \gamma\right)\right) = \underset{s}{max} \left\{u\left(Y_1 - s\right) + \beta E\left[u\left(Y_2 - \tilde{x} + Rs + g\left(w, \tilde{x}, \gamma\right)\right)\right]\right\} \tag{3}$$

Note that s is left unconstrained, but all predictions of the model are robust to credit constraints where $0 \le s \le Y_1$. Denote the optimal value of s as $s^*\left(\gamma\right)$. For simplicity define:

$$c_1 = Y_1 - s^*\left(\gamma\right)$$

$$c_2 = Y_2 - \tilde{x} + Rs^*\left(\gamma\right) + g\left(w, \tilde{x}, \gamma\right)$$

The following first order condition, a standard Euler equation, holds for $s^*\left(\gamma\right)$:

$$\left.\frac{dU}{ds}\right|_{s=s^*(\gamma)} = -u'\left(c_1\right) + \beta RE\left(u'\left(c_2\right)\right) = 0 \tag{4}$$

We are interested in understanding how valuations of a WISA vary with γ. To do this, we define the willingness to accept (WTA) $A\left(\gamma\right)$, which makes a customer indifferent between receiving a monetary payment of $A\left(\gamma\right)$ or receiving an endowment of a WISA with parameter γ:

$$V\left(Y_1 + A\left(\gamma\right), 0\right) = V\left(Y_1, g\left(w, \tilde{x}, \gamma\right)\right) \tag{5}$$

2.2 WISA Valuation

Differentiating Equation (5) with respect to γ and rearranging, while holding s constant, we can write:

$$\frac{dA\left(\gamma\right)}{d\gamma} = \frac{\beta E\left[\frac{dg(w,\tilde{x},\gamma)}{d\gamma}u'\left(c_2\right)\right]}{u'\left(c_1\right)} = \frac{\beta w}{u'\left(c_1\right)}\left\{E\left(u'\left(c_2\right)\right)\left[\frac{1}{1+\lambda} - R\right] + \frac{1}{(1+\lambda)E(\tilde{x})}Cov\left(u'\left(c_2\right), \tilde{x}\right)\right\} \tag{6}$$

This expression reveals two effects.[5] Since $\frac{1}{1+\lambda} < R$, the first term represents the loss from substituting away from savings. The second term represents the gain from acquiring more insurance. Thus $\frac{dA(\gamma)}{d\gamma}$ is of ambiguous sign, and its sign can change over the range of γ.

However, some properties of $A\left(\gamma\right)$ can be determined. From the extreme value theorem, we know there must be a $\gamma^* \in [0, 1]$ which maximizes $A\left(\gamma\right)$. More interestingly, we can show that $A\left(\gamma\right)$ weakly decreases as one moves away from this optimum γ: there are no other local maxima. This is most usefully formalized as

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[5]Continuity and differentiability of the utility function guarantee that $\frac{dA(\gamma)}{d\gamma}$ is defined everywhere, and therefore $A\left(\gamma\right)$ is globally continuous and differentiable.

follows.

Proposition 1. *$A(\gamma)$ has no interior local minima.*

Proof. We will show this in two steps:

1. Prove that if $\frac{d^2}{d\gamma^2} V(Y_1, g(w, \tilde{x}, \gamma)) < 0$, $A(\gamma)$ has no interior local minima.
2. Prove that $\frac{d^2}{d\gamma^2} V(Y_1, g(w, \tilde{x}, \gamma)) < 0$.

Step 1: Show that if $\frac{d^2}{d\gamma^2} V(Y_1, g(w, \tilde{x}, \gamma)) < 0$, $A(\gamma)$ has no interior local minima.

Using the definition of $V(Y_1, g(w, \tilde{x}, \gamma))$ from Equation 5 and applying the envelope theorem:

$$\frac{dV(Y_1, g(w, \tilde{x}, \gamma))}{d\gamma} = \frac{dV(Y_1 + A(\gamma), 0)}{d\gamma} = \frac{dA(\gamma)}{d\gamma} u'(Y_1 + A(\gamma) + s^*(\gamma)) \quad (7)$$

$$\frac{d^2 V(Y_1, g(w, \tilde{x}, \gamma))}{d\gamma^2} = \frac{d^2 A(\gamma)}{d\gamma^2} u'(Y_1 + A(\gamma) + s^*(\gamma)) +$$
$$\frac{dA(\gamma)}{d\gamma} \left[\frac{dA(\gamma)}{d\gamma} + \frac{ds^*(\gamma)}{d\gamma} \right] u''(Y_1 + A(\gamma) + s^*(\gamma)) \quad (8)$$

In general, the sign of the second term in Equation 8 is unclear. Since $A(\gamma)$ is continuous and differentiable, at any local extrema $\frac{dA(\gamma)}{d\gamma} = 0$ and the second term goes to zero. Also at any extrema we have,

$$\frac{d^2 A(\gamma)}{d\gamma^2} = \frac{d^2 V(Y_1, g(w, \tilde{x}, \gamma))}{d\gamma^2} \frac{1}{u'(Y_1 + A(\gamma) + s^*(\gamma))}$$

When $\frac{d^2 V(Y_1, g(w, \tilde{x}, \gamma))}{d\gamma^2} < 0$, $\frac{d^2 A(\gamma)}{d\gamma^2}$ will be less than zero because $u' > 0$. This means that any local extremum must be a maximum, and therefore no interior local minimum can exist. Note that Equation 7 also shows that the γ which locally maximizes $V(Y_1, g(w, \tilde{x}, \gamma))$ will also locally maximize $A(\gamma)$.

Step 2: Show that $\frac{d^2}{d\gamma^2} V(Y_1, g(w, \tilde{x}, \gamma)) < 0$.

Using the envelope theorem,

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$$\frac{d}{d\gamma}V\left(Y_1, g\left(w, \tilde{x}, \gamma\right)\right) = \beta E\left[\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma}u'\left(c_2\right)\right] \qquad (9)$$

$$\frac{d^2}{d\gamma^2}V\left(Y_1, g\left(w, \tilde{x}, \gamma\right)\right) = \beta E\left[\left(\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma}\right)^2 u''\left(c_2\right)\right] + \beta R E\left[\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma}\frac{ds^*\left(\gamma\right)}{d\gamma}u''\left(c_2\right)\right] \qquad (10)$$

The first term is negative, but the second is of ambiguous sign. In order to sign the expression, we can leverage the first order condition for s. Differentiating Equation 4, we get the following expression for $\frac{ds^*(\gamma)}{d\gamma}$:

$$\frac{ds^*\left(\gamma\right)}{d\gamma} = -\frac{\frac{\partial}{\partial\gamma}\frac{dU}{ds}}{\frac{\partial}{\partial s^*(\gamma)}\frac{dU}{ds}} = -\frac{\beta R E\left[\frac{dg(w,\tilde{x},\gamma)}{d\gamma}u''\left(c_2\right)\right]}{u''\left(c_1\right) + \beta R^2 E u''\left(c_2\right)} \qquad (11)$$

Rearranging terms and multiplying both sides by $\frac{ds^*(\gamma)}{d\gamma}$ yields the following equation.

$$\left(\frac{ds^*\left(\gamma\right)}{d\gamma}\right)^2 u''\left(c_1\right) + \beta E\left[\left(R\frac{ds^*\left(\gamma\right)}{d\gamma}\right)^2 u''\left(c_2\right)\right] + \beta E\left[R\frac{ds^*\left(\gamma\right)}{d\gamma}\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma}u''\left(c_2\right)\right] = 0$$

As the above expression is equal to zero, we can add it to the right hand side of Equation 10:

$$\frac{d^2}{d\gamma^2}V\left(Y_1, g\left(w, \tilde{x}, \gamma\right)\right) = \beta E\left[\left(\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma}\right)^2 u''\left(c_2\right)\right] + \beta R E\left[\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma}\frac{ds^*\left(\gamma\right)}{d\gamma}u''\left(c_2\right)\right] +$$

$$\left(\frac{ds^*\left(\gamma\right)}{d\gamma}\right)^2 u''\left(c_1\right) + \beta E\left[\left(R\frac{ds^*\left(\gamma\right)}{d\gamma}\right)^2 u''\left(c_2\right)\right] + \beta R E\left[\frac{ds^*\left(\gamma\right)}{d\gamma}\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma}u''\left(c_2\right)\right]$$

Collecting and factoring the terms inside the expectation operator,

$$\frac{d^2}{d\gamma^2} V\left(Y_1, g\left(w, \tilde{x}, \gamma\right)\right) = \left(\frac{ds^*\left(\gamma\right)}{d\gamma}\right)^2 u''\left(c_1\right) + \beta E\left[\left(\frac{dg\left(w, \tilde{x}, \gamma\right)}{d\gamma} + R\frac{ds^*\left(\gamma\right)}{d\gamma}\right)^2 u''\left(c_2\right)\right]$$

(12)

Both terms are negative due to the concavity of the utility function. Therefore, $\frac{d^2}{d\gamma^2} V\left(Y_1, g\left(w, \tilde{x}, \gamma\right)\right) < 0$. Combined with Step 1, this allows us to conclude that $A\left(\gamma\right)$ cannot have any interior local minima. $\qquad\square$

The intuition for Proposition 1 resembles that of Mossin (1968)'s theorem. A risk averse consumer would fully insure in the absence of loading but only partially insure when the available insurance carries a load. Our theoretical and experimental context involves positive loading, so only partial insurance is optimal.

2.3 Risk and Time Preferences

In this subsection we analyze $A\left(\gamma\right)$ as a function of risk and time preferences. We seek to solve a general model of demand without making overly restrictive assumptions on functional form; hence the model does not always yield unambiguous predictions. Therefore some of the discussion is reserved to the emprical section.

Classical insurance demand models (such as Schlesinger (2000)) predict insurance demand increases in risk aversion. In this paper's model, this is not necessarily the case, as intertemporal smoothing also plays a role. To see how $\underset{\gamma}{argmax} A\left(\gamma\right)$ changes with risk aversion, consider the γ^* and s^* which jointly maximize expected utility U.

$$\gamma^*, s^* \equiv \underset{\gamma, s}{argmax}\, u\left(c_1\right) + \beta E u\left(c_2\right)\ s.t.\ 0 \leq \gamma \leq 1$$

(13)

Assuming that the optimal γ is not at a boundary[6], the following first order conditions will hold.

$$\frac{\partial U}{\partial \gamma} = 0 = \beta E\left(\frac{dg\left(w, \tilde{x}, \gamma^*\right)}{d\gamma} u'\left(c_2\right)\right)$$

(14)

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[6]If $\gamma*$ is at a boundary, a marginal change in risk or time preferences will not affect $\underset{\gamma}{argmax} A\left(\gamma\right)$.

Define a function $v(c)$ which is globally more risk averse (Pratt, 1964) than the original utility function $u(c)$. We would like to to understand how $A(\gamma)$ will differ for a person with utility function $v(c)$ compared with someone with utility function $u(c)$. The following exposition closely follows the proof of Proposition 3 in Schlesinger (2000), which shows (without permitting external savings) that an increase in risk aversion increases insurance demand.

Pratt (1964) guarantees the existence of a function h such that $v(c) = h(u(c))$, $h' > 0$, and $h'' < 0$. Substituting h into the expected utility function, we have the following expression, which represents a person with utility function v who has selected γ^* and s^* (which are the optimal choices for someone with utility function u):

$$U = h(u(c_1)) + \beta Eh(u(c_2)) \tag{15}$$

For someone with utility function v, we must examine how the choice of γ^* compares to their optimal γ. Taking the derivative of Equation 15, utility changes as follows when we increase γ above γ^*:

$$\frac{dU}{d\gamma}\bigg|_{\gamma=\gamma^*} = \frac{ds^*}{d\gamma}\left[-h'(u(c_1))u'(c_1) + \beta RE\left[h'(u(c_2))u'(c_2)\right]\right] + \beta E\left[h'(u(c_2))u'(c_2)\frac{dg(w,\tilde{x},\gamma^*)}{d\gamma}\right] \tag{16}$$

Since U is concave in γ (shown in Proposition 1), if $\frac{dU}{d\gamma} > 0$ then γ^* lies above the new γ which maximizes U. This means that an increase in risk aversion would increase $\underset{\gamma}{argmax}\, A(\gamma)$. However, the sign of $\frac{dU}{d\gamma}\big|_{\gamma=\gamma^*}$ is not immediately apparent. Substituting $u'(c_1)$ from Equation 14 and rearranging,

$$\frac{dU}{d\gamma}\bigg|_{\gamma=\gamma^*} = \beta E\left[\frac{dg(w,\tilde{x},\gamma^*)}{d\gamma}h'(u(c_2))u'(c_2)\right] + \frac{ds^*}{d\gamma}\beta RE\left[u'(c_2)\left(h'(u(c_2)) - h'(u(c_1))\right)\right] \tag{17}$$

The first term in this expression represents the benefits of insurance in the second period and is greater than zero (Schlesinger, 2000). The second term represents the intertemporal smoothing effects of the WISA and is of ambiguous sign. As studied

in Kimball (1990), demand for precautionary savings is governed by the prudence of the utility function, which depends on the third derivative. Therefore, $\underset{\gamma}{argmax}\, A(\gamma)$ will unambiguously increase with risk aversion only if prudence is also weakly decreasing. Under CRRA preferences, relative risk aversion and relative prudence are positively correlated, meaning that under CRRA an increase in risk aversion has ambiguous effects on $\underset{\gamma}{argmax}\, A(\gamma)$.

The model also does not provide a clear indication of how $\underset{\gamma}{argmax}\, A(\gamma)$ changes with the discount factor. As β increases, consumers would show increasing appetite for savings and insurance, but the net effect on $\underset{\gamma}{argmax}\, A(\gamma)$ is ambiguous. The explicit insurance coverage through the WISA and self-insurance through (loading-free) savings could be substitutes. The experimental analysis below measures comparative statics with respect to risk and time preferences, among other objectives, to provide insight where the theory is not conclusive.

In summary, the main prediction of the theoretical model is that for any individual, demand for a mixture of savings and insurance ($0 < \gamma < 1$) should be greater than demand for pure savings, pure insurance, or both. The model does not allow demand for a mixture to be less than demand for both pure savings and both insurance. However, the effect of risk and time preferences on the relative demand for savings and insurance are ambiguous.

3 Experimental Design

3.1 Procedures

To learn more about savings and insurance decision-making, and to pilot WISA features, we recruited 322 male farmers from rural areas surrounding Ahmedabad, India, for a laboratory experiment in April-May 2010. Sessions were conducted in the Ahmedabad office of the Centre for Microfinance. During the computer-based sessions implemented using Qualtrics software, subjects participated in tasks designed to elicit preferences about risk, time, savings, and insurance. The savings and insurance products used in the exercise were real, and participants had the opportunity to leave the session with rainfall insurance policies or vouchers for delayed payments

in the future. Since many of the participants had little prior experience using computers, they were paired with enumerators, one per subject, who read the questions out loud from the screen as necessary and helped enter subjects' answers into the computer. The lab contained 12 workstations, but the interviews were conducted with no more than 4 subjects in the room at a time, in order to allow the participants to spread out and not hear or be influenced by answers of others. Partitions between computers blocked views of other participants' screens, and participants were instructed not to speak to each other during the exercise. Summary statistics on the experimental population are presented in Table 1.

The experimental tasks began with standard time preference elicitation, using hypothetical smaller-sooner vs larger-later questions. Farmers were asked whether they would prefer Rs 80 now or Rs 60, 80, 100, ..., 280, roughly six months later, when insurance payouts were to be determined.[7][8] Risk preferences were measured next, with a real-money task. Subjects were asked to pick from a menu of lotteries where the payout would be determined by a (virtual) coin flip. At the end of the session (after all other experimental tasks were complete) the coin flip was performed, and subjects were paid according to the result. The maximum payout from this risk preference task was Rs 200, corresponding to the wages of 2-3 days of agricultural labor (Ministry of Labour and Employment 2010). Additional implementation details for these and all experimental tasks, along with the complete text of the instructions, are included in the Appendix.

The main part of the experiment came next. Using a Becker-DeGroot-Marschak (BDM) incentive-compatible mechanism (Becker et al., 1964), we established each participant's WTA for each of four WISAs. The WISAs had γ's of $\left\{1, \frac{2}{3}, \frac{1}{3}, 0\right\}$. These products were described, respectively, as a large insurance policy with maximum sum insured of Rs 1500; a medium insurance policy with maximum sum insured of

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[7]The exchange rate on May 1, 2010, was $1 = Rs. 44.

[8]To be clear, throughout the paper we do not regard the intertemporal choices studied here as sufficient to identify the discount function. For example, marginal utility may fall unobservably from the pre-planting time of the experimental sessions to the post-harvest period. Additionally, the discount placed to money received in the future may reflect a lack of trust that the money will actually be received. Instead, we seek to add some intertemporal insight into an important insurance decision-making context.

Rs 1000 plus a guaranteed payment of Rs 60; a small insurance policy with maximum sum insured of Rs 500 plus a guaranteed payment of Rs 120; and a guaranteed payment of Rs 180 after the monsoon.[9] The market price of Rs 500 of insurance coverage was Rs 66, making all the bundles of comparable monetary value.[10]

WTA values were elicited in two ways for the first three γ's (the ones containing some insurance). Specifically, the subjects were also asked to give their WTA under the circumstance that the money paid to give up the WISA would be paid on the day of the experiment, or post-monsoon. These questions allowed us to obtain additional (incentivized) evidence about time preferences. [11]

Choices were recorded by asking subjects to enter bids for each into the computer, by selecting from a multiple-choice menu of Rs 0 to Rs 250 in intervals of Rs 10, with an additional option to choose a WTA of "Greater than 250."[12] Subjects were told that after giving their minimum WTA for each of these 3x2+1 WISA WTA tasks,[13] the computer would randomly select one to be given to the subject, for which a random "offer price" (ranging from 0-250) would be drawn. If the offer price was above the bid for that γ, the participant would sell the WISA back to the experimenter and instead receive the amount of the offer in cash at the end of the experimental session or at the end of the monsoon. If the offer was less than the bid, the subject

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[9]As an example, in the case of $\gamma = 1$, the English version of the question text read as follows: "Consider receiving a gift of one large rainfall insurance policy. This policy can ordinarily be purchased for Rs 180 and pays out a maximum of Rs 1500 in the event of bad rainfall. What is the minimum amount of immediate payment you would require to give up the insurance policy? Our offer to purchase this policy from you will be between Rs 10 and Rs 250. You would receive the payment at the end of today's session." All policies were underwritten by ICICI/Lombard, the largest private, general insurance company in India.

[10]We rounded down slightly (i) to make comparisons between bundles easier, and (ii) because the small insured amount caused the loading on this policy to fall toward the upper end of loadings we have observed in the market.

[11]With $\gamma = 0$, the WISA would be equivalent to the post-monsoon cash, so there was no need to repeat the elicitation in that case.

[12]In most of the analysis below, a stated WTA of "Greater than Rs 250" is conservatively coded as Rs 260. When we run Tobit specifications that formally take into account the censoring, our results are almost identical.

[13]All subjects entered WTA's in descending order, $\left\{1, \frac{2}{3}, \frac{1}{3}, 0\right\}$, alternating between present and future payments. Subjects were permitted to go back and change earlier reported valuations, but did not do so.

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would keep the WISA. Subjects who retained their WISAs got coupons at the end of the experiment that could be brought back to the lab at the end of the monsoon season to claim the proceeds of the WISA. Since all farmers reported WTA's for all γ's, within-subjects comparisons of valuations can be performed.

In addtion, between subjects, we manipulated an aspect of the way that the WISAs were described. One-quarter of participants were randomly assigned to the "Bundle Frame," where the WISAs are described as an insurance policy plus a voucher for guaranteed money. One-quarter were shown the "Insurance Frame," in which the WISAs were presented as an insurance policy with a minimum payout equal to $\gamma * Rs(180)$. This frame was designed to mimic "no claim refund" insurance policies. The rest of the participants were shown the "ICICI Bundle Frame," which is the same as the "Bundle Frame" except that it adds that the farmer could purchase the policy directly from ICICI-Lombard. This frame was designed to test if associating products with a well-known brand would increase WTA.[14] A given farmer faced the same frame throughout the WISA WTA task, so analysis of framing effects will be between-participant. The full text used for these framing manipulations may be found with the rest of the experimental instructions in the Appendix.

To increase the realism of the lab experiments we offered real financial products that paid out money after the monsoon. Delayed payouts (which proxied for savings) were guaranteed by a voucher, which could be redeemed for cash in the Ahmedabad laboratory. Participants had two months after the end of the monsoon to come to Ahmedabad to redeem their vouchers,[15] and also had the option of sending the voucher with someone else who was designated to collect their funds.

The monsoon was normal in Gujarat (and most of India) in 2010, so the insurance portions of the WISA did not pay out.

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[14]Trust in the insurer was emphasized by Cole et al. (2013) as a significant factor in rainfall insurance adoption.

[15]Specifically, they were told that they could redeem their vouchers after the Hindu holiday of Dashera, which corresponded roughly with the end of both the monsoon season and the insurance policy.

4   Experimental Results

4.1   Insurance and Savings Preferences

Our main empirical result is that most farmers prefer both pure savings and pure insurance to any interior mixture of the two.[16] Figure 1 displays the average valuation versus γ, the insurance share of the WISA. Participants reported the highest average valuations of pure savings and pure insurance, with these bids statistically indistinguishable. Valuations for both interior mixtures of savings and insurance were significantly lower than those for pure products. Our finding of an interior local WTA minimum in the percentage of insurance is inconsistent with the standard intertemporal insurance model and Proposition 1.

Figure 1 shows within-subject differences in average valuations as a function of γ. In addition, we group the subjects according to various patterns of the bids, which indicate distinct preferences over insurance or savings. These groups are shown in Table 2. Eighteen percent of respondents were indifferent, which means they had the same valuation for each product. Seven percent preferred savings, i.e., their bids were weakly decreasing in the percentage of insurance contained in the product. Thirteen percent showed a preference for insurance, meaning their bids were weakly increasing in the percentage of insurance contained in the product. Eleven percent preferred an interior mix, which means they had the highest bid for one of the mixture products, with the bids weakly decreasing as one moves away from the highest bid. A strong plurality of 39 percent of the subjects had preferences that corresponded to the average, meaning they showed a preference for both pure insurance and pure savings over any of the mixtures. Twelve percent of subjects did not express clear preferences, meaning that their bids changed directions twice as γ increased.

Regressions of WTA on a quadratic in γ and various controls support these descriptive patterns. Results are shown in Table 3. Column 1 contains only the linear

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[16]Except where specified to the contrary, in this Section for simplicity all analysis we report involves the elicited same-day WTA. For the qualitatively-similar results using the post-monsoon WTA elicitations, see the Appendix. In addition, this Section pools across the between-subjects framing manipulations, to which we return in Section 5.

term of the fraction of insurance, and we find it enters positively and significantly. In Column 2 we add the squared term, and now the linear term is negative while the squared term is positive, which is consistent with the U-shape seen in Figure 1. In Column 3 we run a Tobit (as some values of WTA are censored from above), and find results very close to the OLS specification in Column 2. As the Tobit specification has little effect on the results, we focus hereafter on OLS specifications for ease of interpretation.

4.2 Risk and Time Preferences

Since the previous subsection showed that most people do not have an interior most-preferred insurance share in a WISA, the comparative statics of the optimum with respect to risk or time preferences cannot achieve the interpretation envisioned in subsection 2.3. Nevertheless, the empirical average relationships between WTA and risk and time preferences are of interest and we present them in Table 4.

Recall that we have two methods of calculating discount factors: a set of questions involving hypothetical choices ("Hyp Discount Factor"), and a comparison of WTA for WISAs when the payout from the BDM exercise happens directly after the session versus in the future ("BDM Discount Factor"). Details of the two discount factor calculations are given in the Appendix.

We first look at the correlations between WTA and risk and time preferences for all WISAs. Columns 1 and 2 of Table 4 show that people with higher discount factors have higher WTA, and those who are more risk averse have lower WTA. The partial correlation with the BDM Discount Factor is an order of magnitude larger than the partial correlation with the Hyp Discount Factor. In Columns 3 and 4 we interact the risk and discounting parameters with γ, and find that the interaction terms on the discount factors are not significantly different from zero, while people with higher risk aversion have a preference for pure products ($\gamma \in \{0, 1\}$) over interior mixtures ($\gamma \in \left\{\frac{1}{3}, \frac{2}{3}\right\}$).

5 Interpretation of Findings

Section 2's model predicted that participants' WTA would not have an interior local minimum in γ. However, within-subjects experimental comparisons implied that most people preferred pure savings and pure insurance to any interior mixture of the two. Looking at the heterogeneity of preferences in Table 2, we see that only 49% of the respondents gave results compatible with standard insurance theory. This section analyzes possible explanations.

5.1 Simplicity Preference

Our results could have arisen if respondents were simply confused about the interior WISA mixtures, as they might be more difficult to understand than the pure products. If this were true, a preference for simplicity (or, equivalently here, a suspicion of complexity) could cause people to value pure products over mixtures.

Our between-subjects framing manipulation allows a direct test of this hypothesis. As explained earlier, participants were introduced to the WISAs using the Bundle Frame, the Insurance Frame, or the ICICI Bundle Frame. While the Bundle Frame and ICICI Bundle Frame explained WISAs as an insurance product plus a savings voucher, the Insurance Frame explained WISAs as an insurance policy with a guaranteed minimum payout. Arguably, the Insurance Frame is simpler to understand, as it presents the farmers with just one product to contemplate instead of two. If simplicity preference is operative, we would expect the preference for pure products to be greater for participants shown the Bundle Frames as opposed to the Insurance Frame.

In Table 5, we test this hypothesis directly. Column 1 introduces dummies for the frames to see how they affected subjects' average bids (the simpler Insurance Frame is the omitted category). Compared to the Insurance Frame, the other two frames do not cause significantly different average bids. However, the ICICI Bundle Frame does show bids higher than the normal Bundle Frame, indicating that including the ICICI-Lombard brand increases particpants' WTA. Column 2 interacts dummies for both complex (Bundle) frames with a quadratic in the insurance share γ

to test whether the complexity of the frame varies the relative valuation of savings versus insurance. None of the interaction terms are significant.

Column 3 is the main specification, which pools both complex frames and interacts them with the insurance share γ. The interaction terms are again both economically small and not significantly different than zero, indicating that the general shape of $A(\gamma)$ is unaffected by a more complicated presentation of the products.

More precisely, the coefficients in Column 3 imply the following. For the simpler Insurance Frame, at $\gamma = \frac{2}{3}$, $\frac{dA(\gamma)}{d\gamma} = 40.1$ (95% confidence interval [20.3,59.9]), while for people with either of the more complex frames $\frac{dA(\gamma)}{d\gamma} = 34.4$ (95% confidence interval [21.6,47.3]). Therefore at $\gamma = \frac{2}{3}$ the marginal effects of γ on WTA are not significantly affected by the complexity of the frame. This pattern is consistent across the range of γ.

Finally, rainfall index insurance itself is a confusing product compared to a simple savings voucher. If a preference for simplicity was driving the results, the WTA for pure insurance might be lower than that for pure savings. However, the mean WTAs for these two products are not statistically distinguishable. While we do not have explicit tests for whether a preference for simplicity caused subjects to value the WISAs less than pure products, the available evidence suggests that this is not the case.

5.2   Anticipated Voucher Redemption

Another conceivable explanation for participants' lower valuation of mixed WISAs than pure products concerns their expectations about redeeming their vouchers post-monsoon. In the experiment, 197 participants (61%) received a voucher that could be redeemed for certain cash after the monsoon. Once the vouchers were ready to be redeemed, we repeatedly called all voucher holders who had given us a phone number to remind them that they had money to pick up, and we reminded them how to redeem the voucher. Despite these attempts, only 83 of these people (42%) eventually redeemed their vouchers. Any insurance payouts would have been available for pickup at the same time and location, but recall that the monsoon was normal so insurance payouts did not occur. If during the experiments the farmers took into

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account the possibility that they might not redeem their vouchers, this could have decreased demand for mixed WISAs.

For example, suppose a farmer has a fixed cost of Rs 130 for redeeming the voucher. As the WISAs with interior mixtures ($\gamma \in \left\{\frac{1}{3}, \frac{2}{3}\right\}$) implied guaranteed payments of less than Rs 130, the participant would anticipate not redeeming the voucher in the event the insurance did not pay out, making these bundles relatively unattractive.

However, at least five reasons suggest this mechanism is not driving Section 4's findings. First, as described above, vouchers could be redeemed at any point during an extended period of time, reducing the marginal cost of redemption. Second, voucher redemption could be delegated, so that any fixed costs could be spread across all the participants in a village.

Third, if customers expected their probability of receiving delayed payments to be increasing in the size of those payments (due to fixed costs of voucher redemption), we might expect that the WISA with the smallest guaranteed voucher to have the lowest valuation. This is the 1/3 Savings + 2/3 Insurance product, which has a voucher of only Rs 60. However, the bids for the 2/3 Savings + 1/3 Insurance bundle (which has a voucher of Rs 120) were significantly lower even though the voucher size was larger. Fourth, in the WTA elicitation tasks with post-monsoon offer amounts, described further in the Appendix, respondents' bids were similar to the same-day bids.

Fifth, Table 6 reports regressions showing that the probability of redeeming a given voucher is not correlated with the voucher's size. Further elaboration on this table and other evidence is provided in the online appendix. Together, these considerations make us skeptical that anticipated redemption probabilities drove the main pattern of elicited valuations, in which pure products are valued more than interior mixtures of savings and insurance.

5.3 Diminishing Sensitivity

The key assumption for Proposition 1's result that $A(\gamma)$ cannot have an interior local minimum is the concavity of the utility function. If we relax this assumption, then

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the theory would allow an interior local minimum for $A(\gamma)$. While the assumption of risk averse agents is common, prospect theory (Kahneman and Tversky, 1979) developed partly from evidence that consumers have diminishing sensitivity to both gains and losses, possibly resulting in risk-seeking behavior in the loss domain. For a consumer with diminishing sensitivity, given reference point r, the prospect theory value function v satisfies:

$$\begin{cases} v''(c) < 0 & if \ c > r \\ v''(c) > 0 & if \ c < r \end{cases}$$

If people exhibited diminishing sensitivity around a reference point, this means that their utility function is convex for losses below a reference point, and Proposition 1 fails to hold. In order to see this, let's take a look again at the central result of Proposition 1. Define the reference level of consumption in each period to be r_1 and r_2 respectively. Assuming that people calculate their WTA based on the prospect theory value function[17], Equation 12 now becomes:

$$\frac{d^2}{d\gamma^2}V(Y_1, g(w, \tilde{x}, \gamma)) = \left(\frac{ds^*(\gamma)}{d\gamma}\right)^2 v''(c_1 - r_1) + \beta E\left[\left(\frac{dg(w, \tilde{x}, \gamma)}{d\gamma} + R\frac{ds^*(\gamma)}{d\gamma}\right)^2 v''(c_2 - r_2)\right]$$

(18)

For a consumer with diminishing sensitivity, $v''(c)$ is no longer everywhere less than zero, so the above expression is not necessarily negative. Instead, the sign will be determined by the specific shape of the utility function and the choice of the reference point.

In the first period, we can consider the reference point r_1 to be the amount of first period consumption in a world where the consumer has not recieved a gift of a WISA. If the gift of a WISA causes the consumer to increase (decrease) savings, then $c_1 - r_1$ will be less than (greater than) zero. Unfortunately, the model does not

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[17]In models of prospect theory, total utility is taken to be a weighted sum of "consumption utility," which follows standard assumptions of expected utility theory, and the prospect theory value function. In most circumstances, subjects evaluate individual lotteries according to the value function. (For instance, this setup is defined formally in Gottlieb (2013)) Since stating a WTA is analogous to evaluating a lottery, we assume that WTA would be determined using the value function.

contain clear predictions about how the gift of the WISA will change savings, and therefore the first term has ambiguous sign.

In the second period, the choice of the reference point is less clear. One reasonable choice would be the level of consumption if was no gift of a WISA and when $\tilde{x} = E(\tilde{x})$ (Köszegi and Rabin, 2006). In this case, second period consumption can be above or below the reference point, and therefore the value function is neither globally convex or concave, making the second term also ambiguous in sign.

We can resolve this ambiguity with a few simplifying assumptions. Assume that savings is fixed and that the second period reference point is the level of consumption when $\tilde{x} = 0$. In farming situations, this reference point is not unrealistic, as losses may come during rare catastrophic events while most seasons bring good harvests. In this scenario, we can drop the first term of Equation 18 as first period utility is always equal to reference utility. The second term is positive, as $c_2 - r_2$ is always either zero or negative.[18] In this scenario, $A(\gamma)$ can have an interior local minimum.

In general, the necessary conditions for $A(\gamma)$ to have an interior local minimum are that there is a γ over the range of $0 < \gamma < 1$ that solves the first order condition for γ (found in Equation 9), and also satisfies the following second order condition :

$$\left(\frac{ds^*(\gamma)}{d\gamma}\right)^2 v''(c_1 - r_1) + \beta E\left[\left(\frac{dg(w,\tilde{x},\gamma)}{d\gamma} + R\frac{ds^*(\gamma)}{d\gamma}\right)^2 v''(c_2 - r_2)\right] > 0$$

The intuition behind this effect is as follows. When people have diminishing sensitivity to losses, partial insurance is especially unattractive because the marginal utility of wealth is very low after a large loss. Therefore, the low amount of insurance offered as part of a WISA with a low γ is unattractive, making the WISA unattractive overall compared to the pure products.

Our experiment does not shed light on whether the above necessary conditions are satisfied for people who showed a local minimum in $A(\gamma)$. However, results of

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[18]Note that $v''(c - r)$ is technically undefined when $c = r$. However, we can finesse this issue by assuming that in a world where savings does not adjust, first period utility will always be zero and should therefore be removed from the indirect utility function altogether. For the second term, we simply consider the expectation for all situations where $c_2 \neq r_2$.

our experiment are consistent with predictions of a model with agents who exhibit diminishing sensitivity around a reference point. This would be an interesting topic for further research.

6 Conclusion

Achieving adequate management of rainfall risk is a serious, consequential challenge for farmers around the world. We sought to understand whether and how a savings account with rainfall-indexed returns, a Weather Insurance Savings Account, might help. Contrary to standard theory, most farmers preferred both pure savings and pure insurance to an interior mixture of the two. Alternative explanations like simplicity preference do not appear to account for this fact. Instead, lower valuation of mixed products seems consistent with a model where participants experience diminishing sensitivity to wealth changes around a reference point. Diminishing sensitivity to losses can imply a preference for full insurance over partial insurance. This suggests some WISAs, if offered commercially by financial institutions, may face low adoption rates.

One potential alternative formulation for mixing savings and weather insurance would follow the example of whole life insurance. "Whole weather" policies might entail multi-year coverage, with premiums due each year and insurance coverage for each monsoon. If at the end of the term cumulative premiums exceeded cumulative payouts, the (nominal) difference would be returned to policyholders. A variety of distortions are present in whole life markets (for pointed recent evidence in India, see Anagol et al., 2013), but the substantial market demand for whole life suggests whole weather might also experience widespread adoption.

More promsingly still, recent years have seen considerable successful innovation in the design of microsavings products (Ashraf et al. (2006); Brune et al. (2011); Karlan et al. (2010b)). Our experiments found limited demand for WISAs with $\gamma \in \left\{ \frac{1}{3}, \frac{2}{3} \right\}$. WISAs with a smaller insurance share, for example guaranteeing a non-negative net return (like a one-year whole weather policy), might be attractive as a savings product while providing meaningful risk protection in some environments.

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Appendix

Appendix available online at:

https://www.dropbox.com/s/voknbwgzwgfwgxq/WISA%20Appendix%2020150311.pdf

Figure 1: Average Willingness to Accept for All Products
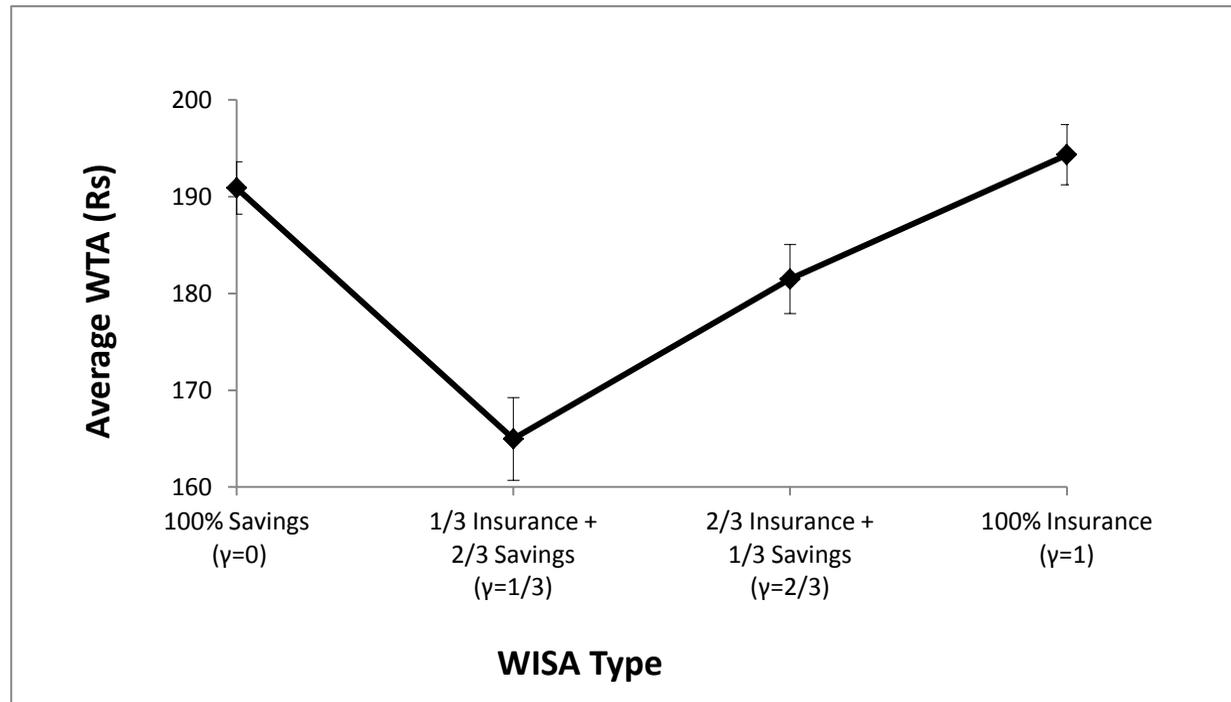
Notes: This figure shows the average valuation of participants for the four WISA products studied. Valuation is calculated as the WTA from a BDM elicitation done as part of the lab experiment. The fraction of insurance γ takes discrete values of 0, 1/3, 2/3, and 1 for each individual. The experiment elicits a WTA for each product, so each individual provides a data point for each γ. Error bars indicate two-standard-deviation bands.

Table 1: Summary Statistics

<u>Personal Characteristics</u>	
Age	43.14
	(13.48)
Land owner	86.65%
	(0.34)
Village distance from Ahmedabad (Km)	23.20
	(3.12)
Have a telephone	43.17%
	(0.50)
<u>Decision Parameters</u>	
Discount factor between experiment and post-ponsoon	0.78
	(0.65)
Estimate of coefficient of partial risk aversion	2.23
	(3.07)
<u>Rainfall Risk Exposure</u>	
If there was a severe drought during the upcoming monsoon season, would the income of you or your family be affected?	
Yes, A Lot	82.92%
Yes, A Little	16.46%
No	0.31%
Have government crop insurance	12.73%
Roughly how much money could you gain from drawing on savings and selling assets if there was an emergency? (Rs.)	7574.34
	(3366.06)
Roughly how much money could you borrow if there was an emergency? (Rs.)	5559.78
	(3654.97)
If there was a serious drought in the upcoming monsoon, how would you and your family cope?	
Draw upon cash savings	36.65%
Sell assets such as gold, jewlery, animals	40.68%
Rely on help from friends and family	49.38%
The government would step in to help	52.80%
Take a loan	44.10%
Number of Respondents	322

Notes: Summary statistics are from participants in the WISA lab experiment, which took place in the Centre for Microfinance computer lab in Ahmedabad, India, from March-May, 2010. Data were gathered using a computer-based survey, with enumerators assisting respondents with data entry into the computers. Standard deviations are in parentheses.

Table 2: Patterns of Preferences
As a Function of the WISA's Insurance/Saving Mix

Preference over γ	Percentage of Respondents
Indifferent	18%
Prefer Savings	7%
Prefer Insurance	13%
Prefer Interior Mix	11%
Prefer Pure Product	39%
Other	12%

Notes: This table classifies subjects by their expressed preferences. Participants are coded as "Indifferent" if their WTA is constant across all products, "Prefer Savings" if their WTA always declines in γ, "Prefer Insurance" if their WTA always increases in γ, "Prefer Mix" if they have an internal maximum in γ, and "Prefer Pure Product" if they have an internal minimum in γ. Participants are coded as "Other" if their bids changed directions twice.

Table 3: Share Insurance and Willingness to Accept

| | Dependent Var is WTA Bid (Rs) | | |
| | (1) | (2) | (3) |
	OLS FE	OLS FE	Tobit
Fraction of Insurance (γ)	8.059***	-79.22***	-72.21***
	(3.006)	(13.79)	(20.33)
Fraction of Insurance Squared (γ²)		87.27***	82.19***
		(13.68)	(20.27)
Constant	178.9***	188.6***	197.5***
	(1.503)	(2.061)	(3.68)
Observations	1,288	1,288	1,288
R-squared	0.695	0.718	

Notes: This table estimates how participants' valuations for WISAs varies with the fraction of insurance (γ) in the product. Valuation is calculated as the WTA from a BDM elicitation done as part of the lab experiment. γ takes discrete values of 0, 1/3, 2/3, and 1 for each individual, so there are four observations for each of 322 individuals, resulting in a total of 1288 observations. The dependent variable for each regression is the WTA bid, in Indian Rupees. Columns 1 and 2 are OLS regressions including individual fixed effects. Column 3 is a Tobit, taking into account censored values of WTA. Robust standard errors are in parentheses. In columns 1 and 2 standard errors are clustered at the individual level.   *** p<0.01, ** p<0.05, * p<0.1

Table 4: Risk and Time Preferences

	Dependent Variable is Willingness to Accept				
	(1)	(2)	(3)	(4)	(5)
Fraction of Insurance (γ)	-84.86***	-84.86***	-84.86***	-47.21	-169.4
	(13.55)	(13.56)	(13.56)	(34.39)	(110.4)
Fraction of Insurance Squared (γ^2)	93.69***	93.69***	93.69***	68.08**	188.3*
	(13.36)	(13.37)	(13.37)	(34.44)	(111.5)
Frac. Ins. (γ) X Risk Aversion				-10.75**	-10.49**
				(5.213)	(5.172)
Frac. Insurance Sq (γ^2) X Risk Aversion				9.489*	9.561*
				(5.191)	(5.130)
Frac. Ins (γ) X Hypothetical Discount Factor				-15.87	
				(33.17)	
Frac. Insurance Squared (γ^2)				5.153	
				(33.47)	
Frac. Insurance (γ) X BDM Discount Factor					112.6
					(110.0)
Frac. Insurance Sq (γ^2) X BDM Discount Factor					-120.9
					(112.2)
Risk Aversion		-1.873*	-3.009***		
		(1.009)	(0.914)		
Hypothetical Discount Factor		23.67***			
		(5.937)			
BDM Discount Factor			235.6***		
			(26.81)		
Constant	189.4***	173.2***	-29.84	189.4***	189.4***
	(2.953)	(6.389)	(25.79)	(2.314)	(2.323)
Individual Fixed Effects	NO	NO	NO	YES	YES
Observations	1248	1248	1248	1248	1248
R-squared	0.030	0.082	0.303	0.717	0.717

Notes: This table shows the relationship between WISA valuation and the fraction of insurance γ, and how this relationship varies with risk and discount parameters. Valuation is calculated as the WTA from a BDM elicitation done as part of the lab experiment. γ takes discrete values of 0, 1/3, 2/3, and 1 for each individual. The sample in all columns is restricted to the 312 participants (out of 322 total) who had risk preferences from the Binswanger lottery that were not inefficient, and discount factors that were calculable from the hypothetical elicitation exercise. There are four observations for each of the 312 individuals, resulting in 1248 observations. There are two discount factors calculated: one using hypothetical questions, entitled "Hypothetical Discount Rate", and one using the BDM procedure, entitled "BDM Discount Rate". Robust standard errors are in parentheses. All errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Framing

	Dependent Variable is Willingness to Accept		
	(1)	(2)	(3)
Fraction Insurance (γ)	-79.22***	-73.06***	-73.06***
	(11.96)	(23.99)	(23.96)
Fraction of Insurance Squared (γ^2)	87.27***	85.70***	85.70***
	(11.85)	(23.76)	(23.74)
(Complex) Bundle Frame	-8.904		
	(7.646)		
(Complex) ICICI Bundle Frame	3.578		
	(7.076)		
Either Complex Frame X Fraction Insurance (γ)			-8.505
			(29.23)
Either Complex Frame X Fraction of Insurance Squared (γ^2)			2.173
			(28.97)
(Complex) Bundle Frame X Fraction Insurance (γ)		-28.03	
		(37.86)	
(Complex) Bundle Frame X Fraction of Insurance Squared (γ^2)		26.80	
		(37.91)	
(Complex) ICICI Bundle Frame X Fraction Insurance (γ)		4.232	
		(31.19)	
(Complex) ICICI Bundle Frame X Fraction of Insurance Squared (γ^2)		-13.89	
		(30.68)	
Constant	189.6***	188.4***	188.6***
	(5.380)	(2.04)	(2.06)
Individual Fixed Effects	NO	YES	YES
Observations	1,288	1,288	1288
R-squared	0.033	0.718	0.719

Notes: This table shows the effect of a complexity vs simplicity framing manipulation on the relationship between WISA valuation and the fraction of insurance γ. Valuation is calculated as the WTA from a BDM elicitation done as part of the lab experiment. γ takes discrete values of 0, 1/3, 2/3, and 1 for each individual. There are four observations for each of the 322 individuals, resulting in a total of 1288 observations. The dependent variable for each regression is the WTA bid, in Indian Rupees. In all columns, the (simpler) "Insurance Frame" is the omitted category. All columns present OLS regressions, and standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Voucher Size and Picking Up Payouts

Dependent Variable:	Voucher is Picked Up		Voucher is Picked Up Before Second Phone Call		Voucher is Picked Up After the Second Phone Call	
	(1)	(2)	(3)	(4)	(5)	(6)
Log Amount of Individual Voucher	-0.0989	-0.101	0.0436	0.0505	-0.143**	-0.147*
	(0.0789)	(0.0843)	(0.0329)	(0.0309)	(0.0660)	(0.0839)
Log of Total Vouchers in Village		0.0618		0.0292		
		(0.122)		(0.0903)		
Village Distance from Ahmedabad (km)		-0.0281		-0.0119		-0.0262
		(0.0228)		(0.0150)		(0.0249)
Have Phone Number	0.0828	0.136	0.0324	-0.00294	0.0504	0.155
	(0.0704)	(0.0879)	(0.0603)	(0.0433)	(0.0676)	(0.0993)
Log of Total Village Vouchers Remaining After Second Phone Call						0.0733
						(0.146)
Constant	0.853**	1.066	-0.0881	-0.0312	0.942***	1.077
	(0.377)	(1.223)	(0.151)	(0.718)	(0.314)	(1.216)
Village Fixed Effects	YES	NO	YES	NO	YES	NO
Observations	197	197	197	197	197	171
R-squared	0.528	0.072	0.372	0.024	0.561	0.083

Notes: This table shows the relationship between the amount of vouchers received and the probability they were redeemed for cash. The sample frame in columns 1-5 is the set of people who received vouchers (redeemable roughly three months later) as part of the experiement. The sample frame in column 6 is restricted to those people who both had received vouchers and lived in a village where there were some vouchers remaining to be redeemed after the second reminder phone call to the village. In columns 1-2, the dependent variable is a dummy taking a value of 1 if the voucher was ever redeemed. In columns 3-4 the dependent variable is a dummy taking a value of 1 if the voucher was redeemed before the second reminder phone call. In columns 5-6 the dependent variable is a dummy taking a value of 1 if the voucher was redeemed after the second reminder phone call. There is one observation per individual. All columns report OLS regressions. Standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.1