Trust, Liquidity Constraints and the Adoption of Index Insurance:

A Randomized Controlled Trial in Ethiopia

Temesgen Belissa[1,4], Erwin Bulte[1], Francesco Cecchi[1,2], Shubhashis Gangopadhyay[2,3,5] and Robert Lensink[1,2]

[1] Development Economics Group, Wageningen University, Wageningen, The Netherlands

[2] Faculty of Economics and Business, University of Groningen, Groningen, The Netherlands

[3] India Development Foundation (IDF), Gurgaon, India

[4] Haramaya University, Ethiopia.

[5] University of Gothenburg, Sweden.

Corresponding author: b.w.lensink@rug.nl

Abstract: We report the results of an experiment in Ethiopia on weather insurance, and examine whether uptake of index-based insurance is enhanced if we allow farmers to pay *after* harvest (addressing a liquidity constraint). We also test to what extent uptake can be enhanced by promoting insurance via informal insurance groups, to reduce trust problems. The delayed payment insurance product increases uptake when compared to standard insurance. Promoting this new product via *Iddirs* results in even greater uptake, but we find no evidence of synergy effects when simultaneously relaxing liquidity and trust constraints. Finally, delayed payment of premiums accentuates the risk of default, but "legal contracts" can reduce this risk.

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1. Introduction

The majority of the world's poor reside in rural areas and their economic fate depends crucially on the performance of the agricultural sector (e.g., World Bank 2007, Haggblade et al. 2007, Christiaensen et al. 2010). To promote intensification of rain-fed agriculture requires the widespread diffusion of agricultural technologies such as improved varieties and fertilizer. However, the adoption of modern technologies remains low and stagnant. Evidence is growing that downside (production) risk is an important factor that impedes the uptake of these technologies (Emerick et al. 2016).[2] Promoting the uptake of insurance against adverse weather shocks in rain-fed production systems may therefore be an important component of strategies to modernize agriculture and lift large swaths of people out of poverty (e.g., Mobarak and Rosenzweig 2013, Cai 2016, Elabed and Carter 2016, Karlan et al. 2014).[3]

In recent years, experiments with index-insurance products have sought to overcome well-known problems associated with indemnity-based insurance: (i) prohibitive transaction costs, (ii) asymmetric information and moral hazard, and (iii) co-variate shocks that are hard to re-insure. Index-insurance delinks pay-outs from farm-level losses, and allows farmers to purchase coverage based on an index correlated with these losses. This may be a measure of average biomass productivity or a measure of local rainfall during a certain time period – variables that are objectively quantifiable and verifiable. Pay-outs are triggered when the index falls short of a pre-determined threshold.

While index insurance may in theory and practice promote agricultural intensification, challenges for development remain because adoption of index insurance is *also* incomplete – typically hovering below 10% (Cole et al. 2013). The literature identifies several reasons for low uptake of index insurance. For example, index insurance provides only imperfect coverage for household shocks if individual damages are not perfectly correlated with the index – as is typically the case. If the index is not identical to on-farm losses, residual risk (or basis risk) remains. Individual losses may be high while the index does not reach the threshold, implying

[2] Of course many other factors also play a role in explaining slow diffusion of new technologies. These include heterogeneity in (net) benefits and profitability (Suri 2011), under-performing extension systems, and lack of liquidity (including lack of access to credit). For a recent overview, refer to Foster and Rosenzweig (2010).

[3] The reason is presumably that purchasing external inputs in a context where harvests may fail is risky – exposing farmers to the risk of becoming indebted and losing valuable assets (Boucher et al. 2008). The pursuit of "low-risk-low-expected return" activities may be perfectly rational in such a context (Walker and Ryan 1990).

insured farmers are worse off than in the absence of insurance because they paid the premium (Clarke 2016). "False negatives" undermine the expected utility of adoption, especially for highly risk averse farmers. The combination of uncertain rainfall and uncertain pay-outs implies the farmer faces a compound lottery, inviting ambiguity aversion (Elabed and Carter 2015).

In this paper we report on the outcomes of an RCT in rural Ethiopia that focused on two alternative reasons for low adoption of insurance: (i) lack of trust in the insurance product (or insurance provider) and (ii) lack of liquidity to pay for the insurance premium.[4] Consider the former first. To "build trust" we vary the marketing channel, and seek endorsement of leaders of *Iddirs*.[5] *Iddirs* are informal social institutions in Ethiopia, originally created to help their members organize burial ceremonies, but currently engaged in a broader spectrum of activities and mutual assistance. We have informed *Iddir* leaders about the benefits of index insurance, and encouraged them to share their knowledge with members of their *Iddir*. It is important to emphasize that insurance was sold to individual members via the traditional channel – the local cooperative. We did *not* sell insurance to *Iddirs* (or through *Iddirs*).

To study the role of liquidity constraints during the planting season we allow (randomly selected) farmers to pay the premium *after* harvest. Many smallholders are unable to mobilize the resources needed to pay for payment of the premium upfront.[6] The standard product demands that farmers pay the premium when disposable income is at its lowest and the marginal utility of cash is at its highest – just before the "hunger season." In return, they might receive compensation after harvest when, no matter how meagre, disposable income is often higher than in the planting season. We allow smallholders to postpone premium payment until after the harvest, and henceforth call this insurance product IOU. The properties of the IOU, except for the delayed payment, are identical to those of a standard product, but the delayed premium is slightly higher to account for the opportunity cost of time (and make the two premiums inter-temporally

[4] Other reasons for imperfect uptake exist. For example, insurance products are "complex" and low levels of financial literacy among target populations imply not all potential beneficiaries understand its logic or recognise the potential benefits (e.g. Cole et al. 2014, Cai et al. 2015). Lack of experience with shocks may also matter as does precise knowledge about the probability of disaster (Cai and Song 2017).

[5] In Ethiopia, *Iddirs* are indigenous voluntary mutual help associations made up by a group of persons united by ties of family and friendship, by living in the same *kebeles*, by jobs, or by belonging to the same ethnic group. The number of members, the composition, the functions, and the organization can differ from one *Iddir* to another. All *Iddirs* are based on voluntary mutual agreements and request intense participation from their members.

[6] Such outcomes may be due to several factors, including poverty gap dynamics and present bias (hyperbolic discounting leading to procrastination – see Duflo et al. 2011).

equivalent). A crucial issue for the viability of delayed payment schemes is default after production uncertainty has been resolved and there was no pay-out. We probe this issue by exploring legally binding contracts and leveraging group dynamics as commitment devices.

Our paper is closest related to the following two papers. First, Dercon et al. (2014) propose selling index insurance to *Iddirs* because there might be important coordination benefits from group-wise purchasing of index insurance – in the presence of basis risk, formal and informal insurance may be complements (see also De Janvry et al. 2014).[7] They evaluate the impact of an intervention that trains *Iddir* members to benefit from post-payout redistribution, and find that such a training increases the uptake of insurance. Our approach does not seek to reduce basis risk by promoting informal sharing. Members purchase their own insurance at the coop, but are informed about the benefits through a traditional leader rather than a company representative or coop employee. The idea is that this approach builds trust or confidence in the insurance product. Second, Casaburi and Wills (2016) study delayed payments of the premium to induce insurance uptake, but their insurance is interlinked with a contract farming scheme (which prevents defaults on the premium payment commitments). They find uptake increases to 72%, compared to 5% for the standard contract. It is an open question whether this result extends to other contracting arrangements, because most smallholders are not engaged in contract farming (Oya, 2012).

We use a factorial design involving 144 *Iddirs* and 8,579 individual subjects to test whether delayed premium payments and the promotion of insurance via *Iddirs* affect adoption of index insurance. We also analyze several approaches to mitigate default. We test for "level effects" and complementarities. Our main results are that the IOU has a large accentuating effect on uptake when introduced in isolation. Promoting standard insurance via *Iddirs* does not significantly increase adoption, but the combination of IOU and *Iddir* outperforms all other modalities. For the basic IOU sub-treatment we find a default rate of more than 15%, which might jeopardize the viability of the scheme. However, we also show that default can be contained by auxiliary measures.

[7] This enables group members to redistribute payouts among each **o**ther. Since members have superior knowledge about true damages, this may reduce basis risk. Observe that traditional indemnity-based insurance typically serves as a substitute mechanism for informal sharing arrangements (e.g., Arnott and Stiglitz 1991).

The remainder of this paper is organised as follows. Section 2 presents a theoretical model that provides a framework for thinking about trust, liquidity and the adoption of insurance. While farmers benefit from buying insurance, large premiums have to be paid up-front when they have liquidity needs to meet expenditures on fertilizers, seeds and various types of hired labour. We show this prevents farmers from buying insurance, and show the IOU relaxes this liquidity constraint – encouraging greater uptake. We also show how lack of trust in the insurance company adversely affects uptake. We next seek to take these predictions to the data. In section 3 we sketch the context, explain the intervention and randomization strategy, and introduce our data. We also show that the randomization "worked" in the sense that we have created well-balanced experimental arms. Section 4 presents the results, considering both the uptake of insurance and default of premiums. Section 5 contains robustness analyses, and the conclusions ensue.

2. A theoretical model

We present an illustrative theoretical model that shows how delayed payment of premiums and increased trust in the insurance product affect uptake of drought insurance. The IOU product is contrasted to a standard one, where farmers pay a premium before uncertainty is resolved and obtain payments depending on the state realized. To focus on trust and liquidity we abstract from basis risk and moral hazard in the exposition.

There is a continuum of farmers indexed by their current liquidity y_0, $y_0 \epsilon [y_0^L, y_0^H]$, with $y_0^H > y_0^L \geq 0$. The measure of all farmers is normalized to unity and has the cumulative distribution denoted F, with $0 \leq F(y_0^L) < F(y_0^H) = 1$, where $F(y)$ is the proportion of farmers with liquidity less than (or equal to) y. There are two periods, $t = 0,1$. There is no uncertainty at $t = 0$ but outcomes in $t = 1$ are uncertain. The farmer has a certain amount of liquidity y_0 in period 0 and an uncertain income $\tilde{y}_1$ in period 1. Period 1 income is positively dependent on rainfall which is stochastic. The farmer's two-period utility without insurance is given by:

$$\underline{U} \equiv u(y_0) + \beta\left[\overline{y}_1 - \left({}^1\!/_2\right)\rho\sigma_y{}^2\right] \tag{1}$$

where, $\overline{y}_1 \equiv E(\tilde{y}_1)$, $\sigma_y{}^2$ is the variance of $\tilde{y}_1$, β represents time-preferences, ρ is the farmer's constant absolute risk-aversion parameter, and E is the expectations operator.

Assumption 1: We assume that $u'(.) > 0$, $u''(.) < 0$ and that $u(.)$ satisfies the Inada end-point conditions. The farmer is risk averse and this is represented by a second period utility function that can be expressed in certainty-equivalent form.

The farmer can buy a rainfall-indexed insurance contract that pays out depending on rainfall realizations. The insurance pay-out, $\tilde{x}$, is inversely dependent on rainfall and given that $\tilde{y}$ is positively correlated with rainfall we have $\tilde{x}$ and $\tilde{y}$ are negatively correlated, i.e., $Cov(\tilde{x}, \tilde{y}_1) \equiv \sigma_{xy}$<0. Let the cost (or premium) for this insurance be denoted π, $\overline{x} \equiv E(\tilde{x})$ and ${\sigma_x}^2$ is the variance of $\tilde{x}$. The farmer has two options: (i) to stay without insurance and have a two-period utility given by (1) or, (ii) buy insurance and obtain a two-period utility given by equation (2) below. Buying insurance entitles the farmer to an income stream $\tilde{z} \equiv \tilde{y}_1 + \tilde{x}$ in period 1.[8]

$$U^0 = u(y_0 - \pi) + \beta\left[\overline{y}_1 + \overline{x} - \left({}^1\!/_2\right)\rho\left({\sigma_y}^2 + {\sigma_x}^2 + 2\sigma_{xy}\right)\right] \tag{2}$$

$$\cong u(y_0) - \pi u'(y_0) + \beta\left[\overline{y}_1 + \overline{x} - \left({}^1\!/_2\right)\rho\left({\sigma_y}^2 + {\sigma_x}^2 + 2\sigma_{xy}\right)\right]$$

where we have used a first-order Taylor expansion to derive the expression in the second line of (2). The farmer buys insurance if and only if equation (2) utility is greater than U, i.e. if:

$$\beta\left[\overline{x} - \left({}^1\!/_2\right)\rho\left({\sigma_x}^2 + 2\sigma_{xy}\right)\right] \geq \pi u'(y_0). \tag{3}$$

The left-hand-side (LHS) of inequality (3) is the additional utility from buying into the uncertain income stream generated by insurance. The right-hand-side (RHS) is the utility cost of buying the income stream generated by insurance. While the benefits from insurance will accrue in the next period, and only if rainfall is low, the premium has to be paid today. The relative comparison of cost and benefit depends on the premium, π, but also on the utility cost associated with losing liquidity today. The same premium will mean different things to different farmers, depending on the amount of liquidity they have today. We measure this cost of liquidity by $u'(y_0)$ with the implicit assumption that as y_0 rises, the cost of liquidity falls. Observe that if $u'(y_0) = 1$, then the RHS of (3) is simply the premium, or the benefit of insurance must be

[8] This results from Var(x+y) = var(x)+var(y)+ 2cov(x,y).

greater than its premium. As y_0 decreases, $u'(.)$ increases, implying that people with smaller period 0 liquidity will suffer a greater utility cost of paying the insurance premium.[9] Given insurance pay-out $\tilde{x}$, let (3) hold with equality at $y_0 = y^*$. Then all farmers with $y_0 \geq y^*$ will buy insurance and others will not buy the insurance. Hence, the proportion of farmers buying insurance equals $1 - F(y^*)$.

Now suppose the farmer has access to the IOU with the same payout plan, but its premium can be paid in the second period. The delayed premium payment is of an amount $\pi(1+r)$ where r is the risk-free interest rate that the insurance company could get on its one-period cash holdings. If the farmer takes this, she gets utility:

$$U^I = u(y_0) + \beta\left[\overline{y}_1 + \overline{x} - \pi(1+r) - \left({}^1/_2\right)\rho\left({\sigma_y}^2 + {\sigma_x}^2 + 2\sigma_{xy}\right)\right] \tag{4}$$

Observe that the two-period utility in (4) will be greater than that in (1) if and only if

$$\beta\left[\overline{x} - \left({}^1/_2\right)\rho\left({\sigma_x}^2 + 2\sigma_{xy}\right)\right] \geq \pi\beta(1+r) \tag{5}$$

There may exist a subsample of farmers who will buy the IOU if offered, even if they do not buy the standard insurance. In particular, farmers with high liquidity cost will not buy the standard insurance, but some of them will buy the IOU if offered. Theoretically, in a perfect capital market, identical rates of time discount, no aggregate uncertainty and with a borrowing rate equal to the lending rate, the rate of time discount will be such that $\beta(1+r) = 1$ and the RHS of (5) collapses to π. This is the same as the RHS of (3) when $u'(y_0) = 1$. The question then boils down to the relative sizes of $\beta(1+r)$ and $u'(y_0)$ and that of $\beta\left[\overline{x} - \left({}^1/_2\right)\rho\left({\sigma_x}^2 + 2\sigma_{xy}\right)\right]$ and π.

One possibility is depicted in Figure 1. On the horizontal axis we measure today's non-stochastic income and the vertical axis measures the money value of utility. Given our assumption of decreasing utility costs of liquidity in income, we obtain the falling $\pi u'(y_0)$ line. By construction, $\beta\left[\overline{x} - \left({}^1/_2\right)\rho\left({\sigma_x}^2 + 2\sigma_{xy}\right)\right] \geq \pi u'(y_0)$ for all $y \geq y^*$ and, hence $[1 - F(y^*)]$

[9] This cost of liquidity in period 0 will depend on a number of different factors in addition to income – size of the family, outstanding debt obligations that are payable today, cost of education of children, etc. For simplicity, we assume income is a sufficient measure of liquidity cost.

proportion of farmers will buy the standard insurance while $F(y^*)$ will not buy anything.

<< Insert Figure 1 here >>

To complete the analysis we consider the firm selling insurance. Since all buyers of insurance (and the IOU) get paid according to a rainfall index, all farmers face the same probability of receiving a pay-out. From Figure 1, we know the proportion of farmers who buy the standard insurance, namely $[1 - F(y^*)]$. Suppose this translates to $N(y^*)$ farmers, with $N'(y^*) < 0$. If the insurance company makes non-negative profit, its expected pay-out must be less than its expected receipt of premium:

$$N(y^*)\overline{x} \leq N(y^*)\pi(1+r) \text{ or, } \overline{x} \leq \pi(1+r) \tag{6}$$

Here we assume that the premium paid in period 0 is held by the insurance company as a risk-less interest bearing asset. For the insurance market to work, both equations (3) and (6) must be satisfied; i.e., for a given rain-indexed schedule of pay-outs $\tilde{x}$, there exists $y^* \epsilon [y_0^L, y_0^H)$ and $\pi \epsilon (0, \infty)$ such that both (3) and (6) are satisfied.

In the IOU, the premium payment is deferred to period 1 and the relevant expressions are (5) and (6). First, let us suppose there is no default, i.e., all farmers pay $\pi(1+r)$ if they sign up for the IOU. Then equation (6) remains the same as long as π is the same in the IOU as it was in the standard insurance. And for (5) and (6) both to hold we need:

$$\left[\overline{x} - \left({}^{1}\!/_{2}\right)\rho\left(\sigma_x{}^2 + 2\sigma_{xy}\right)\right] \geq \pi(1+r) \geq \overline{x} \tag{7}$$

Hence, for insurance to be sustainable we must have $\left(\sigma_x{}^2 + 2\sigma_{xy}\right) < 0$; otherwise, the provider of insurance will make a loss.[10] Assuming this is the case, we can show two results. First, all risk averse farmers will prefer the IOU over the standard product. Second, all farmers will purchase insurance via the IOU if that is offered to them. Both results are clear from Figure 1.

[10] In fact, the following two assumptions need to be satisfied: (a) insurance pay-out and farmer's income are negatively correlated ($2\sigma_{xy} < 0$), and (b) pay-outs must be such that $\left(\sigma_x{}^2 + 2\sigma_{xy}\right) < 0$. Obviously, if (b) is satisfied, so is (a) (since $\sigma_x{}^2 > 0$). The probability that these are satisfied improves as the correlation between the rainfall index and the farmer's income (from farming) improves. If the rainfall index is perfectly (positively) correlated with the farmer's income, i.e., the index used is the amount of rainfall *on* the farmer's land, then there is no basis risk for the farmer. But if the index is based in measurement of rain elsewhere, the correlation may not be perfect.

Next, consider default. The IOU design introduces the possibility of strategic default, or default due to time-inconsistent preferences: some people who promised to pay the premium later do not pay up when the time comes. This problem only emerges in states where the farmer does not receive pay-outs, else the insurance company can always make payments net of $\pi(1+r)$: instead of paying $\tilde{x}$, it can pay $\tilde{x}-\pi(1+r)$. In our experiment, the farmer gets a pay-out (x_1) when rainfall is below a threshold, and she gets a lower amount (x_2, with $0<x_2<x_1$) when rainfall is above between this threshold and a second (higher) threshold. The farmer receives nothing ($x_3=0$) if rainfall exceeds the second threshold.[11] Let the probabilities corresponding to each pay-out state be denoted $q_i, i=1,2,3$ and let D be the default rate. The expected payoff to the company from each farmer is:

$$\begin{aligned} &q_1(\pi(1+r)-x_1)+q_2(\pi(1+r)-x_2)+q_3(1-D)\pi(1+r) \\ &=\pi(1+r)-q_3 D\pi(1+r)-\overline{x}=\pi(1+r)(1-q_3 D)-\overline{x} \end{aligned} \tag{8}$$

For the company to offer the IOU, this expression must be non-negative. Observe that if $D=0$ this non-negativity condition reduces to the last inequality in (7). Also observe that in the presence of default, insurance premiums will go up. Sufficiently high premiums undermine the attractiveness of the IOU for farmers.

Finally we ask how trust enters the farmer's considerations. Farmers must be confident that the provider of insurance will pay up when the state of nature warrants a pay-out. Trust becomes an issue only when the insurance company has to make a pay-out. Let this trust factor be represented by p, or the expected probability that the insurance company will pay-out when this is required. So far we assumed $p=1$. Lack of trust, however, lowers the expected value of the pay-out in state 1 to px_1 and in state 2 to px_2. The expected pay-out from standard insurance is $q_1px_1+q_2px_2$, where q_i, $i=1,2$ is again the probability of state i. Recall that in state 3, the good state, the insurance company is not expected to pay anything. The expected value of pay-outs $\tilde{x}$ reduces to $p\overline{x}$ and its variance is $p^2\sigma_x^2$. Equation (2) is now replaced by

[11] We have assumed here that $\pi(1+r)\geq x_i, i=1,2$. This is not necessary. $\pi(1+r)\geq x_i$ for at least one i is all we need.

$$U^0 \cong u(y_0) - \pi u'(y_0) + \beta\left[\overline{y}_1 + p\overline{x} - \left({}^1\!/_2\right)\rho\left(\sigma_y{}^2 + p^2\sigma_x{}^2 + 2p\sigma_{xy}\right)\right] \tag{2'}$$

$$= u(y_0) - \pi u'(y_0) + \beta\left[\overline{y}_1 + \overline{x} - \left({}^1\!/_2\right)\rho\left(\sigma_y{}^2 + \sigma_x{}^2 + 2\sigma_{xy}\right)\right]$$

$$-\beta(1-p)\left[\overline{x} - \left({}^1\!/_2\right)\rho\left(\sigma_x{}^2(1-p) + 2\sigma_{xy}\right)\right]$$

The utility associated with (2') is reduced by $\beta(1-p)\left[\overline{x} - \left({}^1\!/_2\right)\rho\left(\sigma_x{}^2(1-p) + 2\sigma_{xy}\right)\right]$, which is positive if $0 < p < 1$ and $\left(\sigma_x{}^2 + 2\sigma_{xy}\right) < 0$. As p decreases, reflecting falling trust among farmers in the insurance company, fewer people are willing to buy the standard insurance. In Figure 1, the upper of the two broken lines shifts down, y^* shifts to the right and, $[1 - F(y^*)]$ falls.

How does a lack of trust affect the IOU? Suppose rainfall is such that we are in state 1. Then with probability p the company will pay out $x_1 - \pi(1+r)$, i.e., the amount to be paid in state 1 minus the deferred premium owed to the company. With probability $(1-p)$, the company pays nothing. Similarly, one can enumerate pay-outs in state 2. While lack of trust erodes expected gains associated from taking up insurance, in an IOU context the farmer cannot be made worse off. The most detrimental outcome, where farmers pay a premium but do not receive their fair pay-out, cannot occur.

Finally, consider the situation in state 3. Assume that when this state happens the company comes to collect the deferred premium payment of the farmer even when it denies payment to farmers who are in state 1 or 2. In this case farmers are called upon to make the payment $\pi(1+r)$ with probability 1 even when farmers in state 1 or 2 are receiving pay-outs with probability p, $p < 1$. The IOU then generates an expected payoff to the farmer of $q_1 p[x_1 - \pi(1+r)] + q_2 p[x_2 - \pi(1+r)] + q_3[-\pi(1+r)] = p\overline{x} - \pi(1+r)$. Equation (4) now becomes

$$U^I = u(y_0) + \beta\left[\overline{y}_1 + p\overline{x} - \pi(1+r) - \left({}^1\!/_2\right)\rho\left(\sigma_y{}^2 + p^2\sigma_x{}^2 + 2p\sigma_{xy}\right)\right] \tag{4'}$$

$$= u(y_0) - \beta\pi(1+r) + \beta\left[\overline{y}_1 + \overline{x} - \left({}^1\!/_2\right)\rho\left(\sigma_y{}^2 + \sigma_x{}^2 + 2\sigma_{xy}\right)\right]$$

$$-\beta(1-p)\left[\overline{x} - \left({}^1\!/_2\right)\rho\left(\sigma_x{}^2(1-p) + 2\sigma_{xy}\right)\right]$$

The difference between equation (4) and (4′) is the same as that between equations (3) and (3′), and the comparison between equations (3) and (4) continues to be valid between (3′) and (4′).

3. Intervention and randomization strategy

We work together with Oromia Insurance Company (OIC) in Ethiopia. This organization, in collaboration with the Japan International Cooperation Agency (JICA), developed drought index insurance for crops in the Rift Valley zone of Ethiopia. The product was originally implemented in five districts: Boset, Bora, Ilfata, Adamitullu-Jido-Kombolcha (AJK), and Arsi Negele. The insurance product is marketed and sold twice per year, in months preceding the two rainy seasons (April and September). Insurance provides coverage against losses during the seedling and flowering stages of crop growth. It is marketed and sold via cooperatives. A household that buys insurance pays a premium of ETB 100 per policy (ETB 20 = USD 1). To compensate for the delay in payment, the premium of the IOU was set at 106, with the 6% surcharge based on the interbank rate in Ethiopia. The pay-out depends on the level of rainfall measured at the nearest meteorological station. For rainfall levels below a threshold but above the so-called exit level, a partial pay-out of ETB 250 is made. If rainfall is below the exit level, OIC pays out ETB 500 per policy.

As in many other localities, take-up of index insurance is very low – approximately 7-8%. OIC suspected two constraints are mainly responsible for low uptake: lack of liquidity and trust. To test this, and explore potential solutions, we designed an RCT with multiple treatment arms. Specifically, to relax a binding liquidity constraint we allow farmers to pay the premium after harvest. To generate trust we trained *Iddir* leaders and reached out to potential clients via *Iddirs*. During the training sessions, important aspects of agricultural insurance and the details of the insurance modality that was offered to them (IOU or standard insurance) were explained. We also interacted these treatments, and introduced sub-treatments with contracts (see below) to analyze additional impacts on uptake and default.

We used three districts in the Rift Valley zone for the experiment: Bora, Adami Tullu and Arsi Negele districts. These districts regularly suffer from drought shocks. From each district, we randomly selected four *kebeles*, and 12 *Iddirs* per *kebele*, or a total of 144 *Iddirs*. We obtained lists of all *Iddir* members in our sample. On our pre-sales registration list, all households were registered as a member of only one *Iddir*.[12]

We use multi-level randomization to assign the 144 *Iddirs* to six experimental arms. The six groups, with the associated number of Iddir members per arm in brackets, are as follows:

1) standard insurance, no promotion [*IBI*: 16 Iddirs, N=853];

2) IOU, no promotion [*IOU*: 16 Iddirs, N=685];

3) IOU, no promotion, with binding contract [*IOUC*: 16 Iddirs, N=633];

4) standard insurance, IDDIR promotion [*IBIM*: 16 Iddirs, N=3056];

5) IOU, IDDIR promotion [*IOUM*: 24 Iddirs, N=1887]; and

6) IOU, IDDIR promotion, with binding contract [*IOUMC*: 24 Iddirs, N=1465].

Group 1 is the control group (*IBI*), receiving the standard index insurance product without additional promotion via the *Iddir*. *Iddir* members in group 2 receive the IOU product without additional promotion (*IOU*), and members in group 3 receive the same but also are forced to sign a contract (*IOUC*). This contract was designed to limit default, and was formulated in harsh terms. Specifically, the contract stipulated that members were not only legally liable for the full premium, but in case of default would also be excluded from the Iddir and deprived of its benefits.

Iddir members in group 4 received the standard insurance product with upfront payment (*IBIM*), but supposedly have greater trust in the product as their *Iddir* leader participated in a training highlighting the benefits of insurance. Group 5 received the IOU and promotion via the Iddir (*IOUM*) and, finally, *Iddir* members in group 6 received the most extensive package including delayed payment, leader promotion, and the contract (*IOUMC*).

Observe that the number of households varies across treatment arms. To some extent this reflects differences in the number of households per *Iddir*. More importantly, it is a consequence

[12] A few households were members of 2 *Iddirs*, and to be considered in the experiment these subjects we asked them to choose membership of *only one* Iddir.

of purposeful oversampling of members in groups 4, 5 and 6 so that these groups can be further sub-divided in follow-up work focusing on the *Iddir* channel.

To verify whether randomization resulted in balanced groups we estimate a series of OLS models, regressing household observables on treatment group dummies and a constant (see Tables 1a and 1b below). The constant reflects the comparison group, denoted by *IBI*. The coefficients indicate whether other groups are significantly different from the comparison group, and we test for differences between other groups by Wald tests. Table 1a contains the following demographic variables: *Age* (in years); *Sex* (1 male; 0 female); *Marital status* (married=1; not-married=0); *Education* (years of schooling); *Family size*; *Total income in the last month* (in Birr); *Drought* (a dummy taking value of 1 if the household experienced a drought in the last three years); and *Insurance* (a dummy taking the value of 1 if the household had purchased index insurance during the past three years). Table 1b presents similar tests for a vector of farming variables, capturing quantities of crops produced in the last cropping season (maize, haricot, teff, sorghum, wheat, and barely); a measure of total land under cultivation, and a dummy taking the value 1 if the household had any formal savings.

<< Insert Tables 1a and 1b here >>

Tables 1a and 1b suggest the randomization worked well, especially regarding crop production at baseline—farmers of the different treatment groups produce on average the same products. Compared to control group *IBI*, the average age in treatment groups *IOU* and *IOUC* is slightly lower; households in the *IOU* group experienced a bit more drought; and households in *IOU* and *IOUC* were slightly less likely be insured before. There are also some imbalances regarding family size (compare *IBIM* and *IOUC* as well as I*OUM* and *IOUC*), and regarding drought experiences. However, differences are small, and we will control for these observables in some regression models below.

4. Results

4.1 Uptake

We present post-treatment ordinary least squares regressions to analyze the determinants of uptake, and in particular examine how the different treatments affect uptake. Table 2 present the results, and shows estimates with and without baseline controls.

<< *Insert Table 2 here* >>

The results in column 1 are based on the subsample of treatment arms without promotion of the *Iddir* leader: the groups *IBI, IOU* and *IOUC*. This enables us to distinguish between potentially varying impacts of relaxing liquidity constraints conditional on promotion via the *Iddir*. The constant in column 1 provides mean uptake of the standard insurance product, *IBI*. This uptake rate of 8% corresponds nicely with pre-existing uptake figures by the insurance company for other *kebeles*. An important result is that uptake can be tripled if farmers can delay payment until after the harvest season: in the IOU treatment uptake increases by 17% until 25%. Liquidity therefore appears to be an important cause for low adoption rates. However, when farmers are offered an IOU product combined with a legal contract (*IOUC*), uptake drops to the level of the control group. The uptake-reducing effect of a binding contract suggests either that farmers are unsure about their ability to pay the premium in the future and fear repercussions in case of default, or that a subsample of farmers signing up for the normal IOU product intends to strategically default on their delayed payments in case the weather is "good." This will be examined further below.

Column 2 reports on a similar model, but this time based on the subsample of groups where the insurance product was promoted by the *Iddir* leader. The constant of this term increases to 15%, implying that uptake of the standard product nearly doubles if the leader endorses it (compare to constant of column 1). This suggests that trust matters. If the IOU product is promoted by the leader, uptake jumps up to no less than 43% of the population (*IOUM*). This implies an incredible 540% increase in uptake. Again we find that the existence of a contract has an attenuating effect on uptake. With a contract, the IOU product is taken up twice as much as the standard product (32% versus 15%), but uptake falls compared to the group without a contract (*IOUM*).

Column 3 essentially summarizes these results for the full sample. As before, not surprisingly, the importance of trust, liquidity and contracts are evident. We now also learn that endorsement of the standard product by traditional leaders does not significantly affect uptake. While the coefficient equals 0.08 (the difference between the constants of columns 1 and 2), it is not significantly different from zero.

Similar results eventuate when we include our vectors of baseline controls – demographic variables and crop indicators. The following characteristics are associated with an increased propensity to purchase insurance: being younger and better educated, holding a larger farm, and having a higher income. Somewhat surprisingly we also find that uptake is decreasing in prior experience with droughts and purchasing insurance. The latter correlation may imply that some farmers have purchased insurance elsewhere. The former finding appears inconsistent with Cai and Song (2017) who simulate disaster experience in the lab, and find that gaining experience with such shocks in the game promotes uptake of insurance in real life. It is interesting to observe the negative correlation between levels of own savings and the uptake of insurance. This could be because savings and insurance are substitute mechanisms to hedge against shocks. Binswanger (2012) argued that for index insurance will be less valuable for farmers with access to alternative approaches to cope with shocks.

The success of the IOU intervention, and its potential for "scaling," depends on both the impact on uptake and defaults. Enhanced uptake is positive, but an increase in default limits the scope for scaling up. As a first attempt to better understand the implications of default we therefore consider how different treatments affect adjusted uptake, measured by *Adjusted Uptake = Uptake*(1-Default)*. In column 5 2 we present impacts using this new outcome indicator. As can be seen, the results are consistent with results for unadjusted uptake variable: the combination of the marketing intervention with an IOU works best.

The policy implications of the experiment are as follows: the introduction of delayed payment dramatically increases the uptake of index insurance. This effect is accentuated when the product is marketed via traditional leaders (in *Iddirs*), but attenuated when a legal contract regarding default is introduced as well. We have also learned that a significant increase in uptake cannot be expected from a marketing intervention alone – lack of liquidity seems to be a more important factor explaining low adoption than lack of trust.

4.2 Defaults

Table 3 shows average default rates across experimental arms; for each arm we consider the sub-group of farmers taking up insurance, and next calculate the percentage of these farmers that reneged on (delayed) payment of the premium. Observe there can be no default for the standard index insurance product, because payment of the premium has to be up-front. The standard IOU product has a default rate of nearly 17%, which may compromise financial viability of such a product. Assuming an actuarially fair insurance product, this implies that the IOU premium has to increase to accommodate default. For a default rate of 17%, the premium has to increase by more than 20% (1/0.83). If we also compensate for the opportunity cost of time (6%), then total price of IOU policies will have to be 26% higher than the price of regular IBI policies. It is an open question whether such pricing will curtail demand for the insurance product.

However, Table 3 suggests it may be possible to reduce default rates associated with delayed payment. First consider something that does not seem to work: adding a legal contract to the insurance product. While uptake in the *IOUC* treatment was low (not exceeding the control group, see Table 2), the contract does not bring down default. The default rate in the *IOUC* treatment was 14%, nearly as high as in the basic IOU arm. However, providing information about IOU via *Iddirs* matter greatly for default. In the *IOUM* treatment, the default rate falls to 9% – a reduction of nearly 50% compared to the basic IOU intervention. Adding the legal contract further pushes down default to 5%. Compensating for the opportunity cost of time and the additional risk of default therefore implies the actuarially fair premium of the IOUMC product has to be 11% higher than that of the basis index insurance product.

<< Insert Table 3 here >>

5. Additional analysis

5.1 Iddirs and uptake: the role of information?

We found that marketing via *Iddirs* promotes uptake of IOU insurance. We also hypothesized that the mechanism linking *Iddirs* to uptake is enhanced trust. However, the literature identifies additional reasons why group-based marketing might boost adoption. A potentially important alternative channel is superior information sharing. Group members may be more motivated to learn from co-*Iddir* leaders, or leaders may be better able to convey the complex messages regarding index insurance to their peers. If so, higher uptake in our *Iddir*-based treatment arms would be (partly) due to better understanding of the insurance product; higher financial literacy, or higher cognitive ability.

To test this hypothesis, we organized a midline survey containing 7 cognitive ability questions, 4 financial literacy questions and 5 questions about index insurance (see appendix). We constructed 3 indices by summing the correct answers (scored with a 1) per category: a cognitive ability index; a financial literacy index; and an index-insurance understanding index. Next, we regress these three complementary knowledge indices on a vector of treatment dummies, and report regression results in Table 4. None of the groups score differently on any of the indices, suggesting that differences in information acquisition do not explain variation in uptake across arms. Observe from the constants of the three models that the analysis does not suffer from "floor" or "ceiling effects" – there is no bunching of respondents towards the end of the lower or upper tail.

<< Insert Table 4 about here >>

6. Conclusions

The main finding of our pilot is that while trust in standard insurance products might matter for adoption, marketing via *Iddirs* in and of itself is not sufficient to have a significant impact. The same holds for an IOU with a legal contract aimed at ruling out defaults. However, the combination of marketing via *Iddirs* and IOUs has a big impact on adoption. Thus, our study strongly suggests that a combination of an IOU with a marketing treatment through a socially trusted customary channel will be very successful in enhancing uptake of index insurance. In order to make this a cost-effective scalable intervention, it is important to ensure that default rates are low. Our pilot suggests that this can be achieved by binding contracts. Thus our study provides rigorous evidence that an IOU, with a binding contract marketed via *Iddirs*, will enhance uptake of index-based insurance considerably, without serious default problems.

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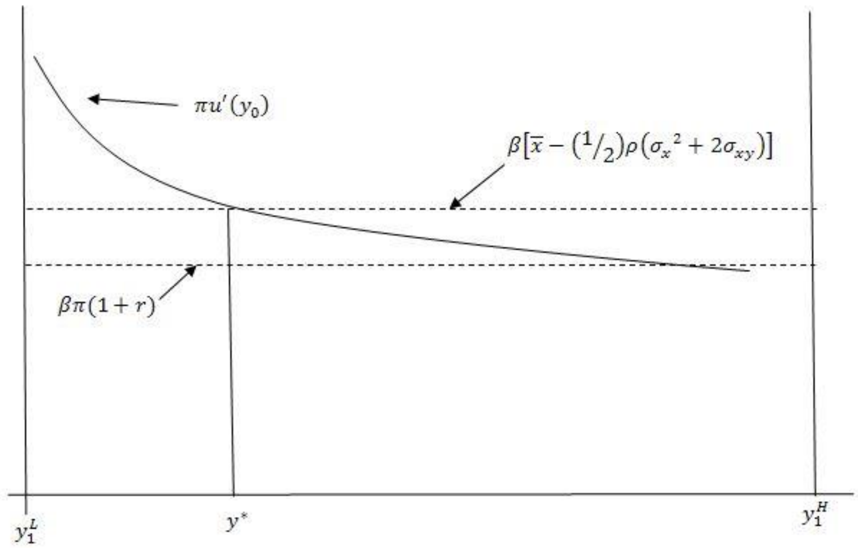

Figure 1. Liquidity and the uptake of insurance

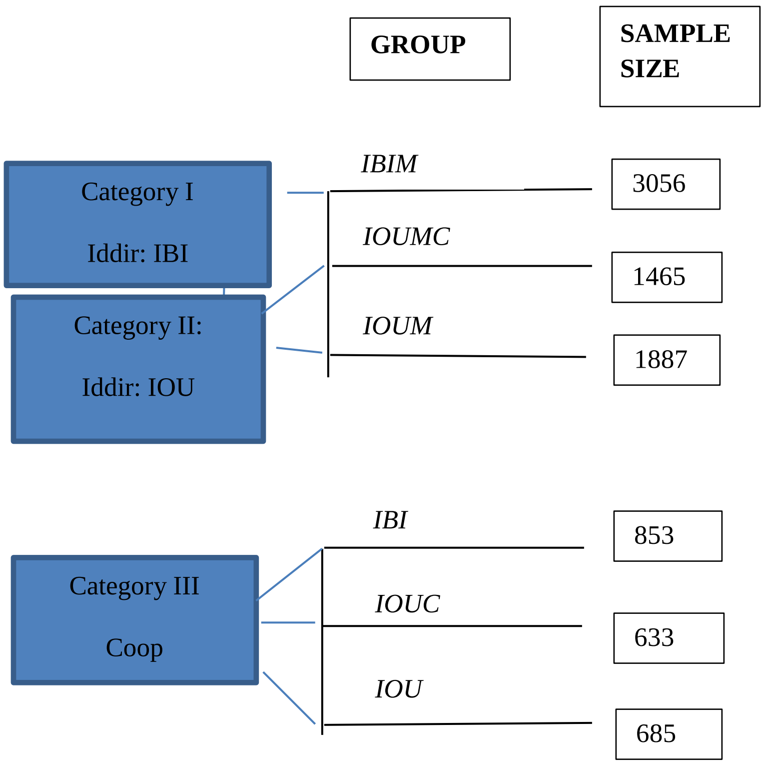

Figure 2: The interventions

Notes: *IBI*: the standard index insurance promoted via cooperatives; *IOU*: The new IOU index insurance promoted via cooperatives; A *M* at the end of the abbreviation refers to marketing treatment (promoted via Iddirs). There are two possibilities: both the standard product and the IOU can be promoted via Iddirs (*IBIM* and *IOUM*, respectively). The IOUs can be offered without a contract (*IOU* and *IOUM*, respectively), or with a binding contract (denoted with a C at the end of the abbreviation; so *IOUC* and *IOUMC*, respectively.

Table 1a: Balance tests on socio-economic variables

VARIABLES	Age (years)	Sex (1=male)	Mstatus	Education (years)	Famsize (ha)	Income	Drought dummy	Bought IBI Before
IBIM	-0.84	0.11	-0.01	0.05	0.14	-198.24	0.01	-0.05
	(1.138)	(0.089)	(0.029)	(0.426)	(0.325)	(186.348)	(0.049)	(0.045)
IOUMC	-1.10	0.16	-0.02	0.05	0.43	62.84	-0.06	-0.03
	(1.361)	(0.096)	(0.031)	(0.473)	(0.429)	(248.140)	(0.059)	(0.051)
IOUM	-0.48	0.12	-0.02	0.34	0.32	303.50	-0.05	0.08
	(1.356)	(0.109)	(0.036)	(0.559)	(0.362)	(558.396)	(0.057)	(0.064)
IOUC	-1.80*	0.02	0.00	0.11	-0.38	-160.66	0.05	-0.08**
	(0.781)	(0.063)	(0.022)	(0.355)	(0.244)	(245.663)	(0.028)	(0.030)
IOU	-2.34**	0.01	-0.03	0.40	-0.19	-58.50	0.07*	-0.09*
	(0.854)	(0.072)	(0.032)	(0.396)	(0.286)	(400.776)	(0.033)	(0.036)
Constant	39.40**	0.47**	0.90**	1.91**	5.67**	854.30**	0.87**	0.12**
(mean of IBI)	(0.901)	(0.073)	(0.025)	(0.347)	(0.299)	(161.121)	(0.041)	(0.041)
Test *IBIM=IOUMC*	0.84	0.58	0.85	0.99	0.38	0.22	0.15	0.58
Test *IBIM=IOUM*	0.76	0.94	0.76	0.55	0.46	0.36	0.18	0.01
Test *IBIM=IOUC*	0.41	0.23	0.65	0.89	0.03	0.86	0.41	0.24
Test *IBIM=IOU*	0.11	0.23	0.59	0.44	0.17	0.71	0.07	0.08
Test *IOUMC=IOUM*	0.66	0.71	0.88	0.59	0.76	0.67	0.87	0.05
Test IOUMC=IOUC	0.61	0.11	0.56	0.91	0.03	0.41	0.04	0.16
Test *IOUMC=IOUC*	0.30	0.11	0.71	0.49	0.10	0.78	0.005	0.08
Test *IOUM=IOUC*	0.33	0.32	0.50	0.67	0.01	0.42	0.05	0.002
Test *IOUM=IOU*	0.11	0.29	0.84	0.92	0.08	0.58	0.005	0.001
Test *IOUC=IOU*	0.44	0.82	0.28	0.35	0.26	0.61	0.12	0.58
Observations	8,579	8,579	8,579	8,579	8,579	8,579	8,579	8,579

Notes: Robust standard errors in parentheses, clustered for 144 Iddirs; *** p<0.01, ** p<0.05, * p<0.1. Test gives p-values of Wald tests. The constant reflects the average in the control group: *IBI*.

Table 1b: Balance tests for production variables and savings

VARIABLES	Maize	Haricot	Teff	Sorghum	Wheat	Barley	Land	Savings
IBIM	2.30	0.19	-0.10	0.07	2.73	-0.13	-0.40	0.06
	(1.201)	(0.158)	(0.380)	(0.144)	(4.212)	(0.132)	(0.867)	(0.068)
IOUMC	2.23	0.17	-0.34	0.01	-1.03	-0.14	0.82	0.01
	(1.513)	(0.148)	(0.375)	(0.103)	(1.767)	(0.134)	(1.178)	(0.068)
IOUM	0.54	-0.01	-0.05	-0.01	0.74	-0.20	-1.24	0.02
	(1.167)	(0.073)	(0.452)	(0.100)	(2.112)	(0.126)	(0.850)	(0.061)
IOUC	0.40	0.03	0.10	-0.08	-0.85	-0.06	-0.05	-0.03
	(0.730)	(0.069)	(0.295)	(0.059)	(0.991)	(0.128)	(0.415)	(0.035)
IOU	0.37	-0.04	-0.05	-0.10	-1.18	-0.14	0.31	0.00
	(0.751)	(0.067)	(0.406)	(0.074)	(1.277)	(0.152)	(0.617)	(0.042)
Constant	6.54**	0.21**	1.35**	0.19*	5.09**	0.29*	8.06**	0.21**
(mean of IBI)	(0.876)	(0.061)	(0.266)	(0.081)	(1.268)	(0.121)	(0.739)	(0.044)
Test *IBIM=IOUMC*	0.96	0.89	0.52	0.69	0.37	0.82	0.24	0.47
Test *IBIM=IOUM*	0.12	0.18	0.92	0.59	0.65	0.27	0.18	0.49
Test *IBIM=IOUC*	0.12	0.30	0.66	0.27	0.39	0.58	0.70	0.16
Test *IBIM=IOU*	0.14	0.13	0.93	0.19	0.34	0.86	0.49	0.38
Test *IOUMC=IOUM*	0.25	0.22	0.52	0.84	0.40	0.47	0.04	0.92
Test *IOUMC=IOUC*	0.24	0.35	0.31	0.27	0.51	0.48	0.48	0.52
Test *IOUMC=IOU*	0.24	0.15	0.54	0.14	0.90	1.00	0.70	0.88
Test *IOUM=IOUC*	0.90	0.60	0.77	0.35	0.41	0.20	0.19	0.41
Test *IOUM=IOU*	0.88	0.61	1.00	0.19	0.31	0.57	0.14	0.78
Test *IOUC=IOU*	0.94	0.18	0.60	0.53	0.50	0.53	0.34	0.35
Observations	8,579	8,579	8,579	8,579	8,579	8,579	8,579	8,579

Notes: Robust standard errors in parentheses, clustered for 144 Iddirs; *** p<0.01, ** p<0.05, * p<0.1. Test gives p-values of Wald tests. The constant reflects the average in the control group:IBI

Table 2: Uptake of insurance product

VARIABLES	(1) restricted sample: coop promotion	(2) restricted sample: Iddir promotion	(3) full sample	(4) with controls	(5) adjusted uptake
IOU	0.17		0.17	0.15	0.13
	(0.067)**		(0.067)**	(0.062)**	(0.059)**
IOUC	0.03		0.03	0.03	0.02
	(0.041)		(0.041)	(0.041)	(0.037)
IBIM			0.07	0.05	0.07
			(0.058)	(0.053)	(0.058)
IOUM		0.28	0.35	0.33	0.31***
		(0.102)***	(0.092)***	(0.086)***	(0.095)
IOUMC		0.17	0.25	0.22	0.23
		(0.097)*	(0.088)***	(0.069)***	(0.089)**
Age				-0.00	
				(0.001)***	
Sex				-0.04	
				(0.037)	
Mstatus				0.02	
				(0.017)	
Education				0.01	
				(0.004)**	
Famsize				0.02	
				(0.005)***	
Income				0.00	
				(0.000)**	
Droughtdummy				-0.09	
				(0.044)**	
boughtIBIbefore				-0.18	
				(0.055)***	
				(0.002)***	
Savings				-0.14	
				(0.046)***	
Indicators crop quantities				Yes	
Constant (*IBI*)	0.08		0.08	0.47	0.08
	(0.029)**		(0.029)***	(0.116)***	(0.029)***
Constant2 (*IBIM*)		0.15			
		(0.051)***			
Observations	2,171	6,408	8,579	8,579	8,579
Adjusted R-squared	0.042	0.075	0.086	0.178	0.074

Cluster robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. IBI= standard index-insurance marketed and sold via cooperatives; IOU= IOU insurance without binding contract marketed and sold via cooperatives; IOUC=IOU insurance with binding contract marketed and sold via cooperatives; IBIM=standard index insurance marketed via Iddirs; IOUM=IOU insurance without contract marketed via Iddirs; IOUMC=IOU insurance with binding contract marketed via Iddirs.

Table 3. Average default rates

VARIABLES	(1)
IOU	0.17
IOUC	0.14
IOUM	0.09
IOUMC	0.05
Observations	1,514

Table 4. Financial literacy

VARIABLES	(1) Cognitive Ability	(2) Financial Literacy	(3) IBI Understanding
IBIM	0.03	-0.11	-0.12
	(0.239)	(0.183)	(0.167)
IOUMC	0.01	-0.02	-0.31
	(0.262)	(0.189)	(0.206)
IOUM	0.35	0.04	0.12
	(0.225)	(0.197)	(0.202)
IOUC	0.27	0.04	-0.15
	(0.166)	(0.125)	(0.114)
IOU	0.20	0.07	-0.05
	(0.170)	(0.141)	(0.144)
Constant	4.29	1.97	3.70
(mean of *IBI*)	(0.173)***	(0.144)***	(0.128)***
Observations	8,579	8,579	8,579
Adjusted R-squared	0.006	0.003	0.011

Cluster robust standard errors in parentheses adjusted for 144 clusters, *** p<0.01, ** p<0.05, * p<0.1.

APPENDICES

A Contracts

A.1 Binding contract

CONTRACT AGREEMENT BETWEEN HOUSEHOLDS AND OROMIA INSURANCE

I (Mr/Ms)____________________________in District_________________ kebele______________________________ have signed a binding contract with Oromia Insurance Share Company in such a way that the Company provides me an index-based crop insurance policy of 100 ETB premium which entitles me with 500 ETB payout in case I incur crop losses due to drought during the 2015/16 production year. In return, I will pay the premium of ETB 106 until October 30, 2016 upon harvesting my yield. If I fail to pay the indicated amount till the due date, I will be (1) legally liable for the amount of the promissory note (2) socially deprived of all my privileges from my IDDIR which includes exclusion from membership, loss of members' participation on funeral ceremonies in case of death of my family members and loss of my contributions to the common IDDIR savings.

Name of the household: ______________________

Signature of the household: ___________________

Date: _____________________________________

Name (Oromia insurance delegate):_____________

Signature: __________________________________

Date:_____________________________________

B Surveys

B.1 Baseline

IOU Index-based Insurance

Household Survey Baseline Questionnaire

Dear Sir/Madam,

We are currently undertaking research on **IOU Index-based Insurance in Ethiopia**. We are collaborating with Oromia Insurance Company (OIC). We would like to ask you some questions related to the relevance and economic benefits of such insurances. We guarantee you that this information is confidential and only used for academic purpose. Please contact Mr. Temesgen Keno (email:temesgen.belissa@wur.nl or Mobile +**251 913938370**) for any other problem.

1. Name ________________ District__________ *Kebele* __________ Age ______Sex _____ Marital status[13] _______Education[14]_____ Family size _________ Mobile/phone No.____________________
2. (a) Did you face a severe drought (1) in 2013?______ (2) in 2014?___________ (3) in 2015?________
3. Did your household buy index-based insurance (1) in 2013?______ (2) in 2014?___________ (3) in 2015?________ (4) Not purchased insurance so far_________
4. If you have bought index-based insurance before, (a) did you collect payouts? _______ 1) Yes 2) No (b) in which year (s)? _____________
5. How much total income[15] in Birr (1) Did you get in the last month? ____________ 2) what would you expect your income to be in the next month? ____________ 3) what would you expect your income to be in the next month if it were a good month? ____________ 4) what would you expect your income to be in the next month if it were a bad month? ____________
6. Indicate the best and the worst years in terms of earning for your household (Tick in Table below)

Year	2011	2012	2013	2014	2015
I earned the BEST income in					

[13] 1=married 2=single 3=divorced/separated 4=widowed
[14] Years of schooling
[15] Include income (1) income from farming (crop sells, livestock or livestock product sells) (2) off-farming income (labor work, sells of firewood, charcoal, building materials, etc) (3) non-farm income (salaried employment, business income, rental income, remittances, pension, etc)

I earned the WORST income in

7. What is your main business? (1) Farming (2) Petty trade (3) other non-farming activities (indicate)___________

8. Please provide me with information related to your crop production in last cropping season in table below

Type of crop/vegetables/fruits	Quantity produced (*quintal*)	High-risk high-return inputs used					
		Fertilizer		Modern seed		Pesticide/herbicide	
		Amount (Kg)	Value (Br)	Amount (Kg)	Value (Br)	Amount (Kg)	Value (Br)
Maize							
Teff							
Sorghum							
Wheat							
Barely							

9. What is your total (in qarxi) (a) cultivated land size? ____________ (b) irrigated land size? ________

10. How much of your cultivated land is (a) owned ________ (b) leased in?_________________

11. Saving, access to credit and credit rationing

    (a) Do you have some saving? _______________1) Yes 2) No

    (b) Do you have any outstanding loan? _______________ (1) Yes (2) No

(c) Did you apply for a bank loan over the last five years?_______________ (1) Yes (2) No

(d) Has your application been accepted?_______________ (1) Yes (2) No

(e) Over the last five years, did you always repay your loan on time? ________ (1) Yes (2) No

12. Please provide me with your estimated average weekly food[16] consumption costs_________________________

1

[16] Include your expenditure maize, teff, wheat, barley, sorghum, rice, pasta, macaroni, lentils, beans, peas, potato, tomato, cabbage, oil, sugar, salt, coffee, drinks, cigarette, khat

2 B.2 Midline

Midline Household Survey Questionnaire for Index-based Insurance

Dear Sir/Madam,

We would like to ask you some questions related to your understanding of IBI. The survey is meant only for academic purpose. Respond as "I don't know (IDK)" for issues which you do not know. Contact Mr. Temesgen Keno (Mobile +**251 913938370**) for any other problem.

Part A: Household basic information

Household ID: ________________Name ______________________Mobile: ___________________*Iddir*________________________

Part B: Cognitive ability

1. How much is (a) one-tenth of Birr 400? ________(b) Birr 400 plus 300?____________ (c) 3 times 6?________________
2. If you buy clothing for Birr 75 and pay Birr 100, how much change should you get? Birr_________________
3. If the chance of getting a loan from a bank is 10%, how many people of 1000 would be expected to get the loan? ____________
4. Transport fee from Zeway to Addis Ababa has doubled b/n 1998 and 2008. If the fee was Birr 34 in 1998, then, it is ________in 2008.
5. A salvage mobile is selling for Birr 300. This is 2/3 of what a new one costs. How much is the cost of a new mobile? Birr___________

Part C: General financial literacy

1. Suppose you had Birr 100,000 in a bank and the simple interest is 20% per year. How much will you have in your account after 5 years without withdrawing any amount?____ (a) more than Birr 200,000 (b) exactly Birr 200,000 (c) less than Birr 200,000 (d) I don't know
2. Suppose interest on your savings was 1% and inflation was 2% per year. After 1 year, how much would you be able to buy with the money? ______(a) more than what can today (b) exactly what you can today (c) less than what you can today (d) I do not know
3. If you borrow Birr 100 from a bank and agreed to pay 2% interest per month, how much will you pay back after 2 months? ______________ Birr 100 (b) Birr 102 (c) Birr 104 (d) Birr 106
4. If you want to borrow Birr 500 today and repay after a month, which of the following loan arrangements do you prefer? ______ (a) Loan 1 which requires a repayment of Birr 600 (b) Loan 2 which requires a repayment Birr 500 plus 15% interest after a month (c) IDK

5. Your neighbour is offering you a goat at a price of Birr 500. You have Birr 500 in your savings account which offers an interest rate of 3% per year. You were planning to buy the goat in next year's livestock market at an expected price of Birr 500+5%. Which one is better for you?____(a) wait to buy the goat at next year's market (b) Buy the goat from your neighbour today (c) Cannot say

Part D: Understanding index-based insurance

As per the insurance agreement between Oromia insurance and your kebele members, if you have bought a 100 Birr premium insurance policy against drought you will be paid up to about Birr 666 for rainfall deficiency below 30mm, on average over 4 months.

1. If it rains 50 mm on average over the 4 months, would you get a payout? _______________(a) Yes (b) No (c) IDK
2. If it does not rain at all over the 4 months, will you get an insurance payout? ____________ (a) Yes (b) No (c) IDK
3. How much of a payout would you receive If it does not rain at all over 4 months? ________ (a) Birr 222 (b) Birr 333 (c) Birr 666 (d) IDK
4. If it rains 15 mm on average over the 4 months, will you get an insurance payout? ________(a) Yes (b) No (c) IDK
5. How much payout would you receive if it rains 15 mm on average over the 4 months? ____ (a) Birr 222 (b) Birr 333 (c) Birr 666 (d) IDK

Part E: Understanding the IOU insurance arrangement

1. Have you ever heard of the IOU insurance? _______ (a) Yes (Continue with the next **Q2**) (b) No (end the interview)
2. Did you buy the IOU insurance? ________(a) Yes (Continue with the next **Q3**) (b) No (end the interview)
3. If you have bought the IOU insurance, why you did so? ______ (a) the IDDIR leader told us to buy (b) cannot pay insurance premium but here I can pay later (c) insurance requires premium payment but here I do not have to pay at all (d) everyone else was buying
4. Do you know (1) the individual liability contract?________(a) Yes (b) No (2) the joint liability contract?__________(a) Yes (b) No

Name and signature of the enumerator ______________________Date of the interview:__________________________

3 *Wald tests*

Table A1: Wald tests comparing impact treatments on uptake

p-value Wald tests
IBIM=IOUMC;0.07
IBIM=IOUM:0.01
IBIM=IOUC:0.55
IBIM=IOU:0.27
IOUMC=IOUM:0.40
IOUMC=IOUC:0.02
IOUMC=IOU:0.49
IOUM=IOUC:0.01
IOUM=IOU:0.12
IOUC=IOU:0.01