Journal of Development Economics 106 (2014) 132–143

Contents lists available at ScienceDirect

Journal of Development Economics

journal homepage: www.elsevier.com/locate/devec

Offering rainfall insurance to informal insurance groups: Evidence from a field experiment in Ethiopia☆

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ARTICLE INFO

Article history:
Received 7 November 2011
Received in revised form 20 August 2013
Accepted 9 September 2013

Keywords:
Insurance
Risk-sharing
Ethiopia

ABSTRACT

We show theoretically that the presence of basis risk in index insurance makes it a complement to informal risk sharing, implying that index insurance crowds-in risk sharing and leading to a prediction that demand will be higher among groups of individuals that can share risk. We report results from Ethiopia from a first attempt to market weather insurance to informal risk-sharing groups. The groups were offered training on risk management and insurance. We randomized the content of training provided to group leaders, with some sessions focusing on the benefits of informally sharing idiosyncratic basis risk. Consistent with learning informed by the theoretical results, we found that members of groups whose leaders had received training that emphasized risk-sharing had considerably higher uptake. We find that this effect can be explained either by a more careful selection of training participants by leaders or a direct impact of the treatment on insurance demand.

1. Introduction

Rainfall risk remains a key problem for Ethiopian farmers. In a recent survey conducted in 2009, 44% of farmers reported serious losses in wealth and consumption due to drought in the last 4 years, and 22% report losses due to too much rain and floods. Rainfall risk also seems to affect the uptake of modern inputs in Ethiopia. Dercon and Christiaensen (2011) report a strong link between willingness to take up fertilizer and weather risk in Ethiopia. This would suggest that these farmers are likely to be interested in insurance.

Crop insurance based on offering indemnity against crop losses is fraught with problems, linked to incentives, costly verification and high transactions costs. More recently, index-based products are increasingly promoted as an alternative, as they offer payouts based on easily observable data, with lower verification and incentive problems, and reduced transactions costs (Barnett and Mahul, 2007; Skees et al., 1999). In this paper, we will study rainfall insurance products that offer a payout when rainfall falls below a particular level, measured at a local rainfall station.

In practice, uptake of index insurance products appears to be low in agriculture in poor settings. For example, Giné et al. (2008) report about 5% uptake for a region in Andhra Pradesh in India; Cole et al. (2013) report uptakes of about 5–10% in Andhra Pradesh and Gujarat. Uptake patterns are also unusual for insurance products, with richer people buying more, and the more risk averse buying less.

Trust and poor understanding of insurance are general explanations often offered to explain why people are not taking up insurance in poor settings (e.g. Cai et al., 2009) in China or (Dercon et al., 2011 in Kenya). They may also hold true for index-insurance products (Cole et al., 2013). In addition Clarke (2011) shows that the basis risk inherent in these products, like any other form of contractual nonperformance (Doherty and Schlesinger, 1990), substantially suppresses rational demand, particularly for the very risk averse. Basis risk is the difference between the losses actually incurred and the losses insured. For example, a farmer may lose his or her entire crop due to disease or a very localized drought but not receive a claim payment from a weather indexed insurance policy because the weather at the contractual weather station was good. The effect on demand can be substantial if basis risk is non-trivial or farmers are very risk averse.

One possible way of overcoming some of these problems is to offer contracts to groups. Groups could internalize many problems of understanding the product and they could also be better placed to enforce insurance contracts, perhaps thereby addressing trust. Importantly, they could also be a means to manage basis risk, to the extent that not all basis risk is perfectly correlated among its members. Most index insurance products are designed to target aggregate shocks that affect a

☆ We gratefully acknowledge funding from the International Growth Centre (http://www.theigc.org/), funded by the Department for International Development (DFID) under the research grant “Drought and informal insurance groups: A randomized intervention of index-based rainfall insurance in rural Ethiopia” led by the Department of International Development, University of Oxford; and from the grant competition organized by Agence Française de Développement, The Bill and Melinda Gates Foundation and the World Bank during the Marketplace on Innovative Finance for Development on the 4th and 5th of March 2010 in Paris. Additional support was provided by the DFID-funded research program “Improving Institutions for Pro-Poor Growth” (iiG). We thank participants of the FERDI workshop on group-based index insurance for useful comments.

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http://dx.doi.org/10.1016/j.jdeveco.2013.09.006

whole community, but leave individual farmers exposed to the threat of idiosyncratic agricultural shocks. If individuals within a group can commit to offer mutual protection to each other against such idiosyncratic shocks, then index products offer better value to farmers. In this paper we provide theoretical and empirical support for this idea.

We state and prove a theorem that shows that, under quite general conditions, within-group risk-sharing and index insurance are complements implying that index insurance crowds-in risk sharing and leading to a prediction that demand will be higher among groups of individuals that can share risk. This is the reverse of the result for indemnity insurance whereby risk-sharing and individual indemnity insurance are substitutes. This result provides the motivation for a randomized control trial in which index insurance products were offered to existing informal insurance groups and a random selection of group leaders were trained on the notion that idiosyncratic basis risk can be shared. We find that this training had a significant and positive impact on demand for index insurance, and on reported risk-sharing.

Mobarak and Rosenzweig (2012) also show, in a contemporaneous paper to this paper, that index insurance and risk-sharing are complements. They present results from rural India showing that risk-sharing becomes a more important determinant of demand for those for whom basis risk is higher. This paper takes a different approach by undertaking an intervention to exogenously vary the salience of risk-sharing in insurance training offered to group leaders, and assessing the impact of this variance on index insurance demand.

Consistent with the fact that index insurance is an unfamiliar and complex product, providing training to farmers about index insurance has been shown to be important in encouraging take-up (Gaurav et al., 2011; Gine et al., 2012). This is consistent with the documented role of financial literacy training in increasing awareness of, and changing attitudes towards, formal financial products (Carpena et al., 2011). In this paper we show that the content of training matters. Randomizing the content of training resulted in differences in take-up among treatment groups. Specifically we use differences in training content to test whether encouraging the sharing of idiosyncratic basis risk among group members increases demand for index insurance.

To explore the complementarity between risk-sharing and index insurance, we collaborated with an Ethiopian insurance company to offer insurance to farmers in three districts (Meskan, Silte and Animelo), about 150 km west of Addis Ababa in 2010. Legal and reputational concerns led the insurance company to insist on contracts with individual farmers. However, the entire marketing was done towards members of an informal insurance group, the iddir, which are funeral societies. These groups are widespread in Ethiopia, with virtually every household a member. Against the payment of a premium, it offers funeral insurance, in the form of support in cash and kind in case someone linked to the member dies. In all communities, a large number of these groups exist, with several dozens of members in each group. Iddirs appear very suitable groups to roll out insurance, as they tend to understand insurance and its functioning, and are well respected by their members and in their communities. In addition to offering funeral insurance to all members these groups have increasingly offered other forms of insurance to some or all members (Dercon et al., 2006). Furthermore, Dercon et al. (2008) show that other informal risk-sharing ties between individual members are strong with households typically reporting a sub-set of members of the same iddir as the individuals upon which a household can rely for support in a time of need. As such we can also think of iddirs as comprising of a collection of individuals who are engaged in strong risk-sharing arrangements with some (but not all) other members.

As part of a marketing campaign we carried out training sessions for iddir leaders and members. Whilst all training sessions had a similar focus, introducing concepts of insurance and explaining in detail the insurance policies, we randomized the content of training received by the iddir leadership. Whilst one training focused on the insurance benefits for individual farmers, other training sessions focused on the insurance benefits when complemented with risk-sharing between group members. Given that our experimental design always focused on groups, there should not have been any difference in uptake across treatment arms if information and understanding of these products were perfect. As these products and their links with informal insurance may not be that easily understood, it was expected that training group leaders on the interaction of risk-sharing and index insurance would increase awareness of the fact that some of the basis risk inherent in these policies could be shared, and change the perceived value of index insurance for those who would be able to commit to such basis risk-sharing strategies. Sharing of idiosyncratic basis risk could have been agreed to by all iddir members (as is the sharing of funeral costs), or it could also have been committed to by smaller subgroups of selected members (as has been the practice with livestock insurance, or reflecting the informal risk-sharing agreements between some members).

Because all other aspects of the marketing were held constant–the transactional and communication roles that iddir leaders played was identical across both training types–the design allows us to focus on the perceived benefits that result from emphasizing sharing policies or payouts to leaders, rather than marketing advantages that groups may have as a result of encouraging trust in the insurance product or reducing transaction costs. The nature of the experiment does not allow us to perfectly disentangle whether the risk-sharing message works primarily through a selection effect (group leader trained on sharing invited different types of people to the meeting who were more likely to purchase insurance), or whether those receiving the risk-sharing message were more likely to purchase insurance. Therefore, whilst we cannot identify from our design whether selling insurance to groups is superior to selling to individuals, we can identify a mechanism, consistent with theory, that may make index insurance more attractive to informal risk-sharing groups than to individuals.

We find that iddirs in which leaders were trained in the benefits of sharing insurance had substantially higher take-up rates than iddirs in which leaders were trained in the individual benefits of insurance. Demand was some nine percentage points higher among iddirs in which leaders were trained in sharing insurance, with this additional demand originating from both iddir leaders as well as trained regular members. We find these estimates to be robust to controlling for community fixed effects, as well as a broad set of farmer characteristics.

Our analysis also shows that these effects are not due to (coincidental) pre-intervention differences across randomized iddirs, nor due to differences in how effective training was in increasing understanding of the policies and the basis risk they held. Rather, training the iddir leadership in sharing policies and payouts encouraged leaders to involve more people in the training exercises. We can also show that in these groups, the selected members are engaged in informal risk-sharing beyond funeral insurance.

The results of our experiment show that the type of training provided to leaders of indigenous groups has important implications for demand for insurance. Our analysis shows either that demand for index insurance is higher among those inclined to share risk, or that insurance marketing that provides messages on risk-sharing increases demand. As such our evidence is consistent with the hypothesis that the benefits of encouraging groups to combine these products with increased risk sharing among members might be large, resulting in substantially larger take-up rates.

If this is the case, the results also suggest that strengthening mechanisms to manage basis risk makes index insurance more attractive to small-holder farmers. The presence of basis risk in index-based insurance means that even actuarially fairly priced insurance products may not be attractive to risk-averse farmers. Understanding mechanisms to manage this basis risk deserve further attention, and the combination of index insurance for aggregate shocks with local risk sharing for idiosyncratic shocks could be one such mechanism.

2. Conceptual framework

Providing insurance through groups could carry a number of possible advantages. Selling through groups reduces the costs of retailing insurance and training group leaders in the insurance product also has additional advantages: they are often more literate and numerate than other members of the group so they may be able to understand the products quickly in a training session and then communicate the key concepts effectively to other members. Moreover, by vouching for the insurance products they can increase trust in the insurance products among other members of the group.

We focus our research question on whether groups of individuals can provide an additional benefit in the case of index insurance. Specifically we ask whether increased risk-sharing among group members can alter their demand for index insurance products. We note that much of the success of micro-credit has been attributed to group lending, not just because of joint liability, but because it reduces transactions costs and allows co-insurance (Feigenberg et al., 2010).

To capture the essence of the interaction between risk-sharing and index insurance purchase consider the following model. There are two agents, 1 and 2. Preferences for agent i are represented by a von Neumann–Morgenstern utility function u_i, defined over own consumption c_i. Agents are strictly non-satiated and risk-averse, that is $u'_i > 0$ and $u''_i < 0$ everywhere for both agents i. Moreover, we will assume that agent preferences satisfy prudence ($u'''_i > 0$) and temperance ($u''''_i < 0$). Whilst originally coined by Kimball (1990) and Kimball (1992) respectively in reference to their roles in characterizing precautionary savings decisions, they have wider relevance in characterizing behavior when there is more than one source of uncertainty as will be the case in our model. More recently, Eeckhoudt and Schlesinger (2006) elegantly motivate such preferences as being equivalent to an intuitive ordering of sets of lottery pairs.[1]

Each agent i has initial wealth w_i and is subject to uncertain binary loss x_i which can take values in $\{0, \bar{x}\}$. We consider two types of insurance product. The first kind of insurance product is individual indemnity insurance for agent i, which pays agent i a net amount $\alpha_i\left(x_i - m\mu_{x_i}\right)$ where $\alpha_i \geq 0$ denotes the proportional rate of insurance purchased, m denotes the insurance premium multiple, and $\mu_{x_i} := E[x_i]$ where $\mu_{x_i} \leq m\mu_{x_i} \leq \bar{x}$.[2] The second kind of insurance product we consider is actuarially fair index insurance, which pays agent i a net amount $\alpha_i(y - m\mu_y)$ where $\alpha_i \geq 0$ again denotes the proportional rate of insurance purchased, $m \geq 1$ the (index) insurance premium multiple, and y a random indexed claim payment, taking values in the interval $[0, \bar{y}]$. A state of the world is therefore a triplet $s = (x_1, x_2, y) \in S := \{0, \bar{x}\}^2 \times [0, \bar{y}]$ and we denote the joint cumulative density function as $F(x_1, x_2, y)$.

Agents commit to some degree of symmetric risk sharing with each other, with agent i making a transfer of $\theta\bar{x}$ to agent $j \neq i$ if agent j incurs a loss of $\bar{x}$ but agent i does not incur a loss. We assume that $0 \leq \theta \leq \frac{1}{2}$ and so $\theta = 0$ corresponds to no risk sharing, $\theta = \frac{1}{2}$ corresponds to full risk sharing, and an increase in θ within this range corresponds to an increase in risk sharing. The exogenous degree of risk sharing committed to, θ, is assumed to be enforceable, although we do not specify a court of justice able to enforce such contracts. Any enforcement constraints are therefore modeled in reduced form as restrictions on θ. This is a modeling short cut, which allows us to capture in a static context the reputations of the agents which would guarantee self-enforceability in a repeated relationship.

The random net wealth of agent i therefore depends both on agent i's insurance purchase decision α_i and θ, resulting in net realized wealth for agent i of

$$\text{Indemnity insurance offered}: w_i - x_i + \theta\left(x_i - x_j\right) + \alpha_i\left(x_i - m\mu_{x_i}\right) \quad (1)$$

$$\text{Index insurance offered}: w_i - x_i + \theta\left(x_i - x_j\right) + \alpha_i\left(y - m\mu_y\right) \quad (2)$$

when offered the indemnity and index insurance products respectively.

It is well understood that individual indemnity insurance can reduce informal within-community risk-sharing, and that informal risk-sharing can crowd out demand for individual indemnity insurance (e.g. Arnott and Stiglitz, 1991; Attanasio and Rıos-Rull, 2000). For example, if one considers agent i's demand for individual indemnity insurance we have the following result.

Theorem 1. Within-group risk sharing and indemnity insurance are substitutes in the sense that an increase in one will reduce optimal demand for the other.

Proof. Using Eq. (1) we may write agent i's expected utility in the indemnity insurance problem as

$$U_i(\alpha_i, \theta) = \int_S u\left(w_i - x_i + \theta\left(x_i - x_j\right) + \alpha_i\left(x_i - m\mu_{x_i}\right)\right) dF(s).$$

It is sufficient to show that this exhibits weakly decreasing differences in (α_i, θ), that is $\frac{\partial^2 U(\alpha_i, \theta)}{\partial \alpha_i \partial \theta} \leq 0$. We have

$$\frac{\partial^2 U(\alpha_i, \theta)}{\partial \alpha_i \partial \theta} = \int_S \left(x_i - x_j\right)\left(x_i - m\mu_{x_i}\right) u''\left(w_i - x_i + \theta\left(x_i - x_j\right) + \alpha_i\left(x_i - m\mu_{x_i}\right)\right) dF(s).$$

Now

$$\left(x_i - x_j\right)\left(x_i - m\mu_{x_i}\right) = \begin{cases} 0 & \text{if } \left(x_i, x_j\right) = (0,0) \text{ or } (\bar{x}, \bar{x}) \\ \bar{x} m\mu_{x_i} & \text{if } \left(x_i, x_j\right) = (0, \bar{x}) \\ \bar{x}\left(\bar{x} - m\mu_{x_i}\right) & \text{if } \left(x_i, x_j\right) = (\bar{x}, 0) \end{cases}$$

and since $0 \leq m\mu_{x_i} \leq \bar{x}$ and $u'' < 0$ everywhere it must be that $\frac{\partial^2 U(\alpha_i, \theta)}{\partial \alpha_i \partial \theta} \leq 0$. □

However, as we now show in our main theoretical result, this intuition does not follow through to index insurance under the following two additional assumptions. First we assume that the correlation between the loss and the claim payment from index insurance is identical for each agent, and therefore the indexed claim payment is more strongly correlated with the average loss than with either agent's individual loss.

Assumption 1. The joint distribution is symmetric in x_1 and x_2, i.e. $F(x_1, x_2, y) = F(x_2, x_1, y)$ for all $(x_1, x_2, y) \in S$.

Moreover, we will assume that the index insurance has been designed to capture aggregate, not idiosyncratic shocks. Specifically, we assume that the net income from index insurance in states with idiosyncratic shocks is on average no larger than the premium $m\mu_y$, ensuring that index insurance purchase makes agents more, not less, vulnerable to idiosyncratic shocks.[3]

Assumption 2. $E[y | x_1 \neq x_2] \leq mE[y]$.

Under these two assumptions we find the opposite result to Theorem 1.

[1] Eeckhoudt and Schlesinger (2006) define compound lottery $B_3(k, \tilde{\varepsilon})$ as giving $-k$ with probability $\frac{1}{2}$ and $\tilde{\varepsilon}$ with probability $\frac{1}{2}$, $A_3(k, \tilde{\varepsilon})$ as giving 0 with probability $\frac{1}{2}$ and $\tilde{\varepsilon} - k$ with probability $\frac{1}{2}$, $B_4(\tilde{\varepsilon}_1, \tilde{\varepsilon}_2)$ as giving $\tilde{\varepsilon}_1$ with probability $\frac{1}{2}$ and $\tilde{\varepsilon}_2$ with probability $\frac{1}{2}$, and $A_4(\tilde{\varepsilon}_1, \tilde{\varepsilon}_2)$ as giving 0 with probability $\frac{1}{2}$ and $\tilde{\varepsilon}_1 + \tilde{\varepsilon}_2$ with probability $\frac{1}{2}$. They then show that prudence is equivalent to preferring $B_3(k, \tilde{\varepsilon})$ to $A_3(k, \tilde{\varepsilon})$ for all initial wealth levels, all $k > 0$, and all zero-mean $\tilde{\varepsilon}$, and that temperance is equivalent to preferring $B_4(\tilde{\varepsilon}_1, \tilde{\varepsilon}_2)$ to $A_4(\tilde{\varepsilon}_1, \tilde{\varepsilon}_2)$ for all initial wealth levels and all zero-mean statistically independent $\tilde{\varepsilon}_1, \tilde{\varepsilon}_2$.

[2] The restriction $m \geq 1$ ensures that the insurance premium is not smaller than the expected claim payment, i.e. the insurance premium can be actuarially fair or actuarially unfair but not actuarially subsidized.

[3] This assumption is more general than that of Mobarak and Rosenzweig (2012), in which $\mathbb{P}[y > 0 | (x_1, x_2) \neq (\bar{x}, \bar{x})]$ is also assumed.

Theorem 2. Under Assumptions 1 and 2 within-group risk sharing and index insurance are complements in the sense that an increase in one will increase the marginal utility of the other.

Proof. Using Eq. (2) we may write agent i's expected utility in the index insurance problem as

$$V_i(\alpha_i, \theta) = \int_S u\left(w_i - x_i + \theta\left(x_i - x_j\right) + \alpha_i\left(y - m\mu_y\right)\right) dF(s).$$

It is sufficient to show that this exhibits weakly increasing differences in (α_i, θ), that is $\frac{\partial^2 V(\alpha_i,\theta)}{\partial\alpha_i \partial\theta} \geq 0$. We have

$$\frac{\partial^2 V(\alpha_i, \theta)}{\partial\alpha_i \partial\theta} = \int_S \left(x_i - x_j\right)\left(y - m\mu_y\right) u''\left(w_i - x_i + \theta\left(x_i - x_j\right) + \alpha_i\left(y - m\mu_y\right)\right) dF(s). \tag{3}$$

Now

$$\left(x_i - x_j\right)\left(y - m\mu_y\right) = \begin{cases} 0 & \text{if } \left(x_i, x_j\right) = (0,0) \text{ or } (\overline{x}, \overline{x}) \\ -\overline{x}\left(y - m\mu_y\right) & \text{if } \left(x_i, x_j\right) = (0, \overline{x}) \\ \overline{x}\left(y - m\mu_y\right) & \text{if } \left(x_i, x_j\right) = (\overline{x}, 0) \end{cases}$$

and so applying Assumption 1 and denoting the cumulative density function of y conditional on $(x_1, x_2) \in \{(0, \overline{x}), (\overline{x}, 0)\}$ as $G(y)$ we may write Eq. (3) as

$$\frac{\partial^2 V(\alpha_i, \theta)}{\partial\alpha_i \partial\theta} = \int_0^{\overline{y}} \frac{\overline{x}\left(y - m\mu_y\right)}{2} \left[u''\left(w_i - (1-\theta)\overline{x} + \alpha_i\left(y - m\mu_y\right)\right) - u''\left(w_i - \theta\overline{x} + \alpha_i\left(y - m\mu_y\right)\right)\right] dG(y). \tag{4}$$

We have that $y - m\mu_y$ is nonpositive for all $y \leq m\mu_y$ and nonnegative for all $y \geq m\mu_y$, and that $\mathbb{E}\left[y - m\mu_y | x_1 \neq x_2\right] \leq 0$ by Assumption 2 and our restriction that $m \geq 1$, and so we are done if we can show that the term in square brackets in Eq. (4) is negative and weakly increasing in y. However, this follows directly from $u''' > 0$ and $u'''' < 0$ as we will now show.

The term in Eq. (4) in square brackets may be written as $u''(c_A(y)) - u''(c_B(y))$, where $c_A(y) := w_i - (1-\theta)\overline{x} + \alpha_i\left(y - m\mu_y\right)$ and $c_B(y) := w_i - \theta\overline{x} + \alpha_i\left(y - m\mu_y\right)$. Now $c_A(y) - c_B(y) = -(1-2\theta)\overline{x} \leq 0$ from our assumption that $0 \leq \theta \leq \frac{1}{2}$, which restricts an increase in risk sharing to be an increase in θ. Combining $c_A(y) \leq c_B(y)$ and $u''' > 0$ we have $u''(c_A(y)) - u''(c_B(y)) \leq 0$ and combining $u'''' < 0$ we have $u'''(c_A(y)) - u'''(c_B(y)) \geq 0$. □

Although motivated by index insurance Theorem 2 holds for many insurance products that are not pure index insurance products.[4] Indeed, the only restrictions we have placed on the insurance product are Assumptions 1 and 2, which would also hold for symmetric indemnity insurance targeted at aggregate shocks, such as multilateral indemnity insurance with a large enough group deductible. Such products are, for example, purchased in Mexico by Fondos, semiformal self-insurance funds for farmers, in which group indemnity insurance from a formal sector insurer protects the group against large aggregate shocks and group reserves finance idiosyncratic shocks within the group (Ibarra, 2004).

Our model assumes that the degree of risk-sharing θ is exogenously determined, constrained due to limited commitment on the part of the agents (Coate and Ravallion, 1993). The model thus predicts that those better able to engage in risk-sharing activities with others will purchase higher quantities of index insurance than those that are not able to engage in risk-sharing. It is the idiosyncratic basis risk inherent in index insurance that drives this complementarity, in particular the extent to which index insurance introduces additional idiosyncratic risk that groups may share. This implies that groups have an advantage over individuals in the purchase of index insurance, not present if indemnity insurance were to be offered. Index insurance is therefore more attractive to groups than to individuals, which can then be expected to result in higher uptake.

In our experiment, restrictions imposed by the insurance company involved meant that we could not simply test this proposition by randomizing the sale of policies to groups and individuals. We were restricted to selling to groups. However, as index insurance is a complex financial product, we undertook a financial literacy intervention aimed at testing this prediction, randomizing the extent to which we explained the principles of Theorem 2 to our groups.

In particular, all insurance was retailed through groups in our research and all training was initially provided to group leaders. However the message of the training sessions was varied, such that in randomly selected sessions group leaders were trained in the intuition of Theorem 2: the idea that sharing basis risk between members could complement the partial cover from the index insurance product. Participants undertook an exercise in which it was made clear that the same weather recorded at the local weather station would have differential impacts on farmers within their iddir and that as a result farmers could benefit by sharing payouts among each other according to need. (For further details refer to the training curricula presented in Appendix 1.[5])

Given that index insurance was a new and complex financial product introduced to farmers in this training, we expect that, as per the documented impact of financial literacy training in Cole et al. (2013), training farmers on the intuition of Theorem 2 would create awareness of the benefits of combining risk-sharing activities and index insurance purchases. Our prior is then that this increased understanding would then lead to higher purchases of index insurance by members of these particular groups. In the next section, the nature of these groups, the experimental design and the likely possible mechanisms by which this awareness may have affected uptake is discussed in more detail.

3. Experimental design

3.1. Context and sample selection

We market insurance to pre-existing iddirs or traditional funeral societies, which are the most widespread and inclusive of all informal institutions across rural Ethiopia. The typical size in most of rural Ethiopia is about 50–100 members per iddir. With very few exceptions all households are members of one iddir. Iddirs do not have links with either government or NGOs. Historically, iddirs have been informal arrangements aimed at providing support to households at time of a funeral. Members' contributions were mostly made at the time of a funeral, however over the past two decades iddirs have started to formalize and provide more services to members (Dercon et al., 2006). In general the iddir activities are now formalized in that they collect regular premiums, and payout in cash and in kind at the time of a funeral in a member's family. This is the main source of support that iddirs provide, and for most iddirs is the only form of grant (i.e. non-loan) payments made.

In addition to providing cash and grain at the time of a funeral, some iddirs have started to diversify into other activities such as livestock insurance, fire insurance and health insurance through a system

[4] Theorem 2 also holds under weaker assumptions if one considers asymmetric sharing rules.

[5] In the discussion of sharing basis risk it was also indicated to leaders that they could share the purchase of index insurance also. This is one way of addressing basis risk, as it allows more divisibility of insurance products, thereby allowing a more optimal portfolio of policies to be purchased. In practice we find that only 6% of those that purchased reported sharing policies, suggesting that this was not the mechanism by which increased demand was observed. Throughout the rest of the discussion, we refer to the training as encouraging sharing of payouts, but it could similarly have resulted in sharing of purchasing policies.

of emergency loans. Some of these additional activities are made available to all members in the iddir, but some are available to specific members for whom the activity is most relevant. For example iddirs that have entered into providing livestock insurance have allowed a sub-group within the iddir to form of interested members that own livestock. In addition, iddirs comprise members who rely on each other for help outside of the formal iddir structure. Dercon et al. (2008) find that the most important people that a household can rely on for support are nearly always family members or members of the same iddir. As such we can also think of iddirs as comprising of individuals who are engaged in risk-sharing arrangements (beyond funeral insurance) with each other. It is important to note that prior to our intervention, agricultural risk was only shared informally between members with no iddirs providing formal payouts to members on account of harvest failure.

Seventeen rural wards (kebeles) were selected in the Meskan, Silte and Anilemo districts (woredas). Each kebele contains 2–3 villages, and an iddir listing revealed 117 iddirs with a membership of 100 members or more. The iddirs in these kebelesare quite old, established, on average, over thirty years ago. The oldest iddir was established in 1950, and the youngest in 2008. The mean number of member households is 175. The majority of iddirs require regular payments on a monthly or bi-monthly basis with the yearly contribution amounting to 33 Birr on average (about $2 using the current exchange rate of 17 Birr to $1). Households receive about $60 on the death of a member. Focus groups revealed that households are usually members of two to three iddirs and that these iddirs provide a number of other services too, such as payment in the event of livestock death and household fire, and loans for health care costs.

3.2. Weather-index insurance products

Nyala Insurance Share Company (NISCO) offered weather-index insurance policies in the seventeen selected kebeles. The policies offered followed a "building block" approach to product design: eight deficit rainfall products were designed, two for each of the key rainy months of the main cropping season in the area. The policies took the form of monthly contracts whereby a fixed payout would be due if the cumulative monthly millimeter precipitation recorded in the nearest National Meteorological Agency (NMA) station fell short of a particular target. For each month there were two policies with two different targets: a moderate loss target (resulting in a policy that paid out on average once in every five years) and a severe loss target (resulting in a policy that paid out on average once in every ten years). The targets were selected using historic data from the local rainfall stations and knowledge of the agronomic requirements of commonly used crops in the study areas. For more information on the policy design see (Hill and Robles, 2011). Both types of policy paid out 500 Birr if the rainfall fell below the cutoff and nothing otherwise. The moderate loss policy cost 100 Birr and the severe loss policy cost 50 Birr. Both policies were priced at their expected value (using historical data to assess the probability of payout). The multiple on the policy was thus 1, with project funds being used by NISCO to cover additional costs. This was done in order to encourage demand for insurance in the first year of its rollout in this area, but it is worth noting that the cost of a policy was still considerable when compared to the on average 33 Birr yearly contribution to the iddir.

NISCO uses groups in the marketing and contracting of all of its weather-index insurance contracts (Meherette, 2009). NISCO contacts the group leaders, provides them with information about the product, and asks them to tell other farmers in the group about the product and to collect information on demand among group members. Interested group members fill in a demand schedule in which they enter their name, the size of the land that they would like to insure, the crops they grow and the policies that they would like to buy. Group members sign to indicate that they are happy to ask the group leaders to act on their behalf with NISCO. The group leaders present the filled demand schedule to NISCO along with collected premiums and ask NISCO to issue the policy. NISCO issues the policy for the total insurance purchased by the group, appending the demand schedule to indicate who payments are to go to. This policy is signed by the group leaders. Certificates are issued to all members who purchased insurance. These certificates reference the collective policy number. If payouts are made NISCO issues the payment to the group leaders who are to make the disbursements to members as per the demand schedule.

NISCO normally uses this procedure to contract through farmers' cooperative unions. In this pilot they agreed to contract through large iddirs (iddirs of 100 members or more) and follow the same procedure. They also agreed to the provision of basic training to iddir leaders on the policies.

3.3. Insurance training

In the areas of study, we identified 117 iddirs with more than 100 members to take part in the insurance training, with an average of 7 such iddirs per kebele. As part of the marketing campaign, training sessions for iddir leaders and leader-nominated members were implemented in all kebeles. Each training session lasted about 4–5 h with a 1–2 h lunch break in the middle.

The training sessions discussed general issues of risk and insurance, explained in detail the workings of the NISCO insurance policies, and trained farmers in how to choose the most suitable policy for them. We randomized the content of the training session across iddirs in the following way. In each kebele, we randomly allocated iddirs to two types of training exercises:

- Training A: Framed insurance as an individual decision, focused on the individual benefits of insurance, and illustrated how an individual farmer could choose the right policies for himself.
- Training B: Framed insurance as something that could benefit the group, focused on the benefits of sharing payouts among members as a way of overcoming some basis risk, and illustrated how a group of farmers could choose the right combination of policies for the group.

In terms of our model, training B framed and explained the index insurance product as something that is complementary to the risk-sharing activities undertaken by members of the group, whilst training A entirely ignored this, framing it entirely as an individual decision with no implications for considering this as a group. The length of each training session was kept similar across all types. Training A and B only differed in the framing and the discussion of how to make decisions in the last half hour of the training. If training B helps group leaders to understand these products better, especially their attractiveness for those involved in risk-sharing, it could be expected that uptake is higher in this treatment arm.

Randomization took place using a full list of iddirs larger than 100 members. Randomization was done using a single random draw. There was no stratification by kebele. In a number of kebeles the iddirs have developed a federated structure whereby a large iddir has several smaller "sub-iddirs" underneath it. By restricting the list of iddirs to include only iddirs of 100 members or more we were, in most cases, excluding the sub-iddirs and allocating the large iddirs to one training type or another.

All iddir leaders of the large iddir (typically a committee of 3–5), and leaders of any of the sub-iddirs within it were eligible to attend the training session. After the leaders had received their training, leaders nominated selected regular members to also receive training. All members, regardless of the type of training their iddir leaders were assigned to, received training A. Thus the element that was randomized was whether or not the leaders received training type A or training type B.

Iddir leaders were free to choose who they would nominate for the subsequent training. Allowing leaders to select members after training allowed the training to affect both who leaders selected for training and what the leaders discussed with selected members. It may be the case that both are important mechanisms by which the training would have an effect, with an altered message having little impact if those who were selected could not be changed. As such, asking leaders to select members prior to the training or selecting specific members ourselves could have potentially limited the impact of the training.

We did impose some limits, however, in that the number of people they could select was prescribed. Leaders were randomly allocated a number of members they were asked to invite (from 0 to 18). This prescription was somewhat of an artificial construct, but it allows us to distinguish between the impact of the leader training on the number of people leaders subsequently selected, from any other effects of iddir training such as the messages the iddir leaders discussed with members, or the type of members they selected.

It may be the case that the number of people trained affects demand. If iddir members spoke with each other about the training after the training ended and if these discussions encouraged demand then being in an iddir in which more people were trained may make it more likely that members would buy insurance. In order to test this we randomized the number of members iddir leaders were asked to nominate for the training the following day. This randomization was orthogonal to the training type the iddir leaders received.

In a few cases, the sub-iddirs had more than 100 members and so were also on the randomization list (this federated structure was not recorded at the time of listing). In some of these cases the umbrella and sub iddir were allocated to the same type of training session, but in some cases the large iddir was allocated to one training session and the sub-iddir to another. Given that all iddirs are categorized on the basis of the training received within the large iddir as a whole, for these iddirs there is essentially a third possible treatment category: being in a mixed iddir in which some leaders attended one type of training session, and other leaders another.

There are thus essentially three groups of iddirs in our treatment data: those whose leaders attended training A, those whose leaders attended training B, and those whose leaders were mixed between the two sessions. We note here that the probabilities of allocation to treatment varied depending on whether or not an iddir had one of its sub-iddirs on the list. For iddirs with no sub-iddirs on the list, the probability of allocation to treatment A or B was 0.5, whilst for iddirs with one sub-iddir on the list the probability of allocation to treatment A or B was 0.25 and the probability that it would be mixed was 0.5. We control for this de-facto stratification in the analysis by adding strata dummies to all regressions. Additionally, to focus on the difference between iddirs in which all leaders received training A and iddirs in which all leaders received training B, we include a dummy for iddirs that received the mixed treatment.

Aside from the difference in framing and content there was no other difference between the sessions. Each trainer conducted training sessions of each type to ensure that results are not driven by trainer effects. At the end of each training session iddir leaders were given the same demand schedules for their members to fill. Whilst the training sessions were carried out by a team of trainers purposely hired by the research team, the demand forms were collected by NISCO staff. The collection of the demand forms took place approximately two weeks after the training sessions. Policies were issued on the basis of these demand forms.

3.4. Hypotheses to be tested

Our randomization design thus allows us to test two hypotheses. First, that training iddir leaders on sharing risk increases demand for insurance. Provided there is imperfect understanding of the complementary benefits of index insurance and informal risk-sharing in the group (in line with Theorem 2), training B may lead to higher uptake. Indeed, as will be discussed in more detail later, this is what we find, with nine percentage points higher uptake in iddirs in which the leadership was made aware of the intuition of Theorem 2. The only difference in the training and retailing of insurance was the addition of training on Theorem 2 and any differences in reported behavior or demand are as a result of this curriculum difference. Second, we test the hypothesis that the number of ordinary members trained increased demand.

Our design also allows us to explore the mechanisms by which training iddir leaders on sharing risk increases demand. In particular, as explained earlier, after the training leaders were asked to send some members of the iddir to a subsequent training session held the following day. The differences in the training received may have resulted in selection effects on who and how many people they sent for training. The increased awareness may also have encouraged leaders to change both who they discussed the training material with, and/or what they discussed. With this in mind we set out possible mechanisms by which training could have increased demand.

Having been made aware of Theorem 2, leaders could have passed on the principles of Theorem 2 to these members. This would be the simplest mechanism to affect demand among their members.

Leaders could also have selected and informed members who they judged are most able to benefit from index insurance, namely those members engaged in active risk-sharing arrangements with each other, or in the terminology of our model, those with high θ. Alternatively (or additionally), having been made aware of Theorem 2, leaders could engage in a different type of discussion with members following the training: noting the benefits of risk-sharing not just for this policy, but in general, they could have encouraged a higher level of risk-sharing among some or all members of the group than had previously been present. In the terminology of our model, this would amount to increasing θ. Both of these activities would result in a higher level of risk-sharing being observed among those selected by leaders to receive training on index-insurance.

Finally, rather than selecting those more likely to share risk, or encouraging them to increase risk-sharing (higher θ), our design could have resulted in those being trained in Theorem 2 to be more enthusiastic about index insurance thereby encouraging more of their members to attend training. The higher number of members trained could then have had a direct impact on demand and potentially also a positive externality as more individuals would have been informed about insurance and able to discuss it with neighbors (Gine et al., 2012).

This offers us four possible mechanisms by which training B could have increased demand: first, a simple (social) learning effect in which understanding is transmitted by the leaders to their members; second, a selection effect, whereby leaders select the members most likely to benefit from the policy; third, a further learning effect, in which the leaders use their acquired knowledge to encourage more risk-sharing among their members (raising θ), and finally, no particular selection or social learning via the leaders, but just an encouragement that more people receive training.

The mechanisms are not mutually exclusive, and all would result in higher demand for insurance. However, in the first and last mechanism demand is increased, not by increased risk-sharing but as a result of an additional marketing message being transmitted to leaders. In the second and third mechanism training on risk-sharing increases the level of risk-sharing observed among selected members. All four mechanisms are explored further below using data on the numbers and characteristics of members that were selected for training.

Prior to exploring these mechanisms further, it is important to highlight again that risk-sharing is taking place in these groups at various levels: there is risk that is shared formally by all members in the iddir, risk that is shared formally by sub-groups of individuals in the iddir, and risk that is shared informally by members in the iddir. Theorem 2 applies equally to all of these types of risk sharing, but as discussed before it is important to note that prior to our intervention, agricultural risk was only shared informally between members with no iddirs providing formal payouts to members on account of harvest failure. We may thus expect that training on the intuition of Theorem 2 would have had most relevance for informal risk-sharing arrangements, at least in the short-run. As discussed below, and whilst not conclusive, the evidence that we have is most consistent with this: we find that not all members were aware of the index insurance products (as would have been the case were formal risk-sharing increased), and we find evidence consistent with leaders selecting individuals in active risk-sharing arrangements for training.

3.5. Verifying randomization and testing compliance

We use two data sources in this paper: a baseline survey of iddirs conducted in December 2009 and January 2010; and data collected in a household survey conducted in June and July 2010, two months after the training exercise. The sampling frame of the household survey was constituted by the full memberships of iddirs that took part in the training exercises. We randomly sampled iddir members whereby we over-sampled farmers that had taken part in the training exercises. From a total of 333 respondents, 204 took part in the training. The sample is representative of all iddirs, but without weighting it is not representative at the individual level. However, given our randomization, our interest is on differential impacts between different training sessions, so this is less of a problem.

The web appendix describes the sample. We use the data in the baseline survey of iddirs and characteristics of members collected in the household survey that are unlikely to have changed as a result of the training (characteristics of the household head, land ownership etc.) to test whether characteristics of groups and their leaders were balanced across allocation to training type. Table 1 presents results comparing iddirs whose leaders were allocated to training B to the other iddirs. A similar table in the appendix presents results comparing iddirs whose leaders were allocated to be split across training sessions ("mixed" iddirs) to other iddirs. We find that there are few differences across treatments in any baseline characteristics of groups or their leaders and members. Of 39 variables tested, only 2 are significantly different at 5% or less.

To test compliance with the training type allocation we compare attendance during the training sessions with the initial randomization.

Table 1
Test of balance between iddirs in which leader was allocated to training B and others.

	Leader received Training A or mixed	Leader received Training B	Test of difference (p-Value)
Group characteristics (77 groups, 24 type B)			
Year of creation	1979	1977	0.71
Number of members	182	184	0.93
Share that are women	0.05	0.06	0.93
Requires regular payments	0.69	0.94	0.05
Annual regular payments (Birr)	30	43	0.05
Number of regular payments	15	16	0.95
Entry fee (Birr)	141	100	0.28
Payout on adult death (Birr)	1090	891	0.19
Prop. of members that are farmers	0.96	1.00	0.26
Leader characteristics (68 leaders, 21 type B)			
Age	39.23	41.67	0.31
Gender (1 = female)	0.02	0.00	0.51
Can read (1 = yes)	0.73	0.62	0.47
Can write (1 = yes)	0.73	0.62	0.47
Education (years)	5.26	5.10	0.86
Born in this kebele (1 = yes)	0.96	1.00	0.34
Holds an official position (1 = yes)	0.28	0.33	0.64
Parents held official position (1 = yes)	0.23	0.14	0.40
Relatives hold an official position (1 = yes)	0.57	0.43	0.27
Member of a cooperative (1 = yes)	0.51	0.67	0.24
Number of iddirs of which a member	2.83	3.10	0.40
Log of land owned (timads)	1.24	1.26	0.92
Own a mobile phone (1 = yes)	0.40	0.38	0.86
Member of an eqqub (1 = yes)	0.09	0.00	0.17
Has a bank account (1 = yes)	0.04	0.05	0.93

There was no particular order to the training sessions (the order of training session A and B was randomized within kebeles), and there was no advertisement about the type of training session that was to be offered (this information was not shared with the person making the appointments). As such we do not have cause to believe that there was any endogenous choice represented in iddir-leaders choosing which day to attend training (in fact we find that only two iddirs had all of their leaders attend on the wrong day). However, we would be more concerned that there is a difference between iddirs in which the leadership chose to split themselves between training (when they were selected to attend together), and iddirs in which the leadership attended the training together.

In two kebeles the training allocations were erroneously disregarded. We do not have cause to believe that there was anything particular about the places in which these sessions were conducted as this mistake happened only in the kebeles visited by one team, the teams were randomly assigned to kebeles, and this team made the same mistake in all of their sessions in which no other member of the research team accompanied them. We exclude these kebeles from the analysis.[6]

There was very little non-compliance in the remaining kebeles. Non-compliance rates were only 8%. Out of 71 iddirs, 6 attended the wrong training session: 1 iddir switched from A to B, 1 switched from mixed to B, 1 switched from A to mixed and 3 switched from B to mixed. To ensure that our results are robust to any non-compliance, we use initial training to estimate the intent to treat (ITT) effect, and use the initial allocation as an instrument for actual training.

On completion of their training, iddir leaders were asked to select a certain number of members from their iddir to attend a training course about the insurance the following day. Each iddir was given a randomly determined number of members to attend the course the following day. In Table 2 we compare the number assigned with the number that showed up and assess whether there is any systematic deviation in the number of people that attended.

We find that the number of members assigned to attend the training session the following day does predict the number of people that turned up the following day, but we also see that there were systematic deviations depending on the type of training the leadership of the iddir had received. In particular we see that the number of people attending is higher when the iddir leadership had received training B. This could reflect a higher level of enthusiasm among iddir leaders about the insurance products after having received the training.[7] In all regressions we use the number of members assigned to attend training.

4. Empirical results

Our randomization design allows us to test two things: first, whether training B which trained iddir leaders on Theorem 2 increases demand for index insurance, and second, whether the number of ordinary members trained affects demand. We start our analysis by presenting results of these tests in Section 4.1 and find that both significantly increased demand.

We then examine who increased demand as a result of the leadership being trained in Theorem 2. We find that only those who were selected to be trained increased demand. This suggests that if higher demand is resulting from higher θs among those selected for training in training B iddirs, this is not as a result of iddir-wide increases in risk-sharing, but more risk-sharing in sub-groups of members.

Our finding that leaders attending training B encouraged more members to attend the subsequent training session already suggests that the fourth mechanism defined in Section 3.4 was at work. Before exploring

[6] As expected, adding these kebeles reduces the size and significance of the estimated results, but the qualitative findings remain the same.

[7] We note that there is no difference in the number of leaders that attended training between training sessions A and training sessions B. The p-value of a t-test of equality is 0.415.

Table 2
Number of ordinary members attending training.

	(1) Number attending training	(2) Difference between number attending and number allocated
Number of members allocated for training	0.292**	
	(0.112)	
Iddir in which leader received training B		2.139*
		(1.277)
Constant	2.441***	−1.502
	(0.812)	(0.992)
Observations	70	70
R-squared	0.213	0.106

Standard errors corrected for clustering at the iddir level are in parentheses.
District and strata fixed effects are included but not shown.
*** p < 0.01.
** p < 0.05.
* p < 0.1.

the other three mechanisms by which training iddir leaders on sharing basis risk increases demand, we confirm in Section 4.3 that providing training B to leaders did not result in better training and improved understanding of the products being offered. We find that it did not. Understanding of millimeters and understanding of basis risk was not significantly different between iddirs whose leadership had received training A or training B.

To further explore the mechanisms by which increased demand resulted, we first test whether there were differences in the levels of discussions in iddirs assigned to training A or B (Section 4.4). Whilst differences in post-training discussions are consistent with all mechanisms described, they would be particularly consistent with a story in which training B increased social learning, enthusiasm or increased risk-sharing among members. Although there is some evidence of positive externalities from training members, we find little direct evidence of increased discussions among members.

Secondly, in Section 4.5, we test whether there are differences in reported risk-sharing behavior between those in iddirs in which the leaders received training A or training B. Evidence of a difference would be consistent with the second (selection) or third mechanism (encouragement to raise θ). We have reports of risk-sharing behavior that encompass a reference period spanning 10 months prior to the intervention and 2 months after the intervention. Differences in reported risk-sharing could either reflect changes in risk-sharing as a result of the training exercise, or pre-existing differences in risk-sharing between iddir A and B households. Given that our survey oversampled trained members, pre-existing differences in surveyed households would reflect differences in those selected to attend training in iddirs A and B.

We find that iddir B households are more likely to report sharing risk beyond funeral insurance, which suggests it was the nature of the additional message that resulted in higher demand. To further explore whether this is as a result of selection we test for differences in other characteristics of households. We find no differences in baseline characteristics, but we do find differences in beliefs that others are trustworthy and honest. This could reflect differential selection across training types, but equally we cannot rule out the possibility that this difference is itself an impact of the intervention.

4.1. Demand for insurance

Basic data on take-up among the three iddir types for both trained and untrained farmers included in the baseline survey is presented in Table 3. The data show high demand for insurance among farmers who had heard about the policy. We find that across all sampled farmers 22% had purchased a policy, and that among those that were, trained take up was 36%. Take-up was much lower, just 2%, among those that were not trained.

We asked farmers directly why they did or did not purchase insurance and found that the main reason given for purchasing insurance was to protect their family from crop losses (25% of households) whilst the main reason for not purchasing insurance was not knowing about it (30% of households). Other significant responses were wanting to try a new product to see how it worked (6%), wanting to do what others were doing (7%) and wanting to wait and see how it fared for others before buying it (5%). Price was mentioned as a constraint by only 1% of households. In the online appendix we present results from a correlation of insurance purchase decisions and individual characteristics and confirm that receiving training is highly correlated with an insurance purchase. We also find that households with smaller land holdings, with younger household heads who hold official positions are more likely to purchase and that purchases are correlated with being impatient and believing in the honesty of others.

Table 3 also explores whether take-up varies across training types. Whilst take-up was 18% among sampled members of type-A iddirs, demand for insurance among sampled members of iddirs whose leaders had received training that emphasized the role of groups is 27%, nine percentage points or 50% higher.

We test this formally by estimating the intent to treat (ITT) as follows:

$$d_{ij} = \alpha + \beta_g g_j + \beta_n n_j + \varepsilon_{ij} \quad (5)$$

where d_{ij} is a measure of demand for individual i in iddir j, g_j indicates the training that leaders of iddir j were allocated to, and n_j is the number of ordinary members that leaders were asked to select for training. Trained farmers were purposively selected (iddir leaders and those they nominated) so we focus our analysis on the impact of the element of the training that was random—the allocation of the iddir leaders to training type and the number of members that leaders were requested to select for subsequent training.

We are interested in the impact of training type on demand, β_g. We include a dummy for those iddirs that received mixed training such that a test of the significance of β_g is a test of whether iddirs in which all leaders received training B are different from iddirs in which all leaders received training A. Strata dummies are also included in the estimation given that random allocation included stratification of iddirs. Coefficients on the mixed training dummy and strata dummies are not reported.

Results are presented in Table 4. In columns 1 and 2 we present regression results at the iddir level. The dependent variable in column 1 is the proportion of sampled farmers in the iddir that reported purchasing a policy. In column 2 the dependent variable is whether or not any sampled farmer in the iddir reported purchasing a policy. In columns 3 and 4 we present results at the household level. In column 3 no additional regressors are included, in column 4 characteristics of households that were collected after training but unlikely to have changed over time are included in order to increase precision of the estimates of the treatment effects. An F-test that all characteristics are jointly significant indicates that the null hypothesis of joint insignificance can be rejected ($F(9, 69) = 4.16$). District fixed effects are also added for the same reason. In columns 3 and 4 we correct for correlation across individuals at the level of the iddir, the unit of randomization, by adjusting standard errors for clustering within an iddir.

Table 3
Purchase rates as a percentage of surveyed households.

	Training A	Training B	Mixed
Leader	0.36	0.50	0.18
Trained member	0.26	0.43	0.58
Untrained member	0.02	0.02	0.00
Total	0.18	0.27	0.26

Training A (B) means that iddir leadership was trained in session A (B); trained members were all trained in A.

Table 4
Estimates of the impact of treatment on insurance demand (ITT and IV).

	Intent to treat (ITT)				Instrumental variable (IV)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Average demand in group	Anyone in group purchased	Individual purchased	Individual purchased	Average demand in group	Anyone in group purchased	Individual purchased	Individual purchased
Training B	0.154**	0.294**	0.113*	0.133**	0.167**	0.314**	0.115	0.159**
	(0.069)	(0.133)	(0.062)	(0.054)	(0.081)	(0.155)	(0.079)	(0.065)
Number allocated to training	0.020**	0.021	0.013*	0.014*	0.020**	0.020	0.013*	0.014*
	(0.008)	(0.016)	(0.007)	(0.008)	(0.008)	(0.016)	(0.008)	(0.008)
Constant	0.073	0.329***	0.113**	0.119	0.067	0.317***	0.097*	0.108
	(0.059)	(0.113)	(0.049)	(0.123)	(0.061)	(0.117)	(0.050)	(0.126)
Basic characteristics	No	No	No	Yes	No	No	No	Yes
District fixed effects	No	No	No	Yes	No	No	No	Yes
Observations	70	70	290	288	70	70	290	288
R-squared	0.134	0.100	0.027	0.126	0.137	0.096	0.005	0.129

Standard errors corrected for clustering at the iddir level are in parentheses.
District and strata fixed effects are included but not shown.
Training B means that iddir leadership received training B.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

In all specifications we see that allocation of leaders to training B substantially increased demand with estimates of β_g positive and was significant in all columns. This suggests that emphasizing the role of groups in mediating insurance substantially increases take-up. Demand was also higher in iddirs which were assigned more members for subsequent training. This is not surprising given that purchase rates were much higher among those who were trained (Table 3) than among those who were not.

Taking the iddir level results in column 2, we see that the impact of training B was quite sizeable; increasing the probability that someone in the iddir would buy insurance by 29%. We also instrument actual training received using training allocation as an instrument. Specifically the estimation strategy used is:

$$d_{ij} = \alpha + \beta_\gamma \widehat{\gamma_j} + \beta_n n_j + \varepsilon_{ij} \quad (6)$$

where $\widehat{\gamma_j}$ is the estimate derived from the following equation:

$$\gamma_j = a + \beta_g g_j + \beta_n n_j + \int_{ij}. \quad (7)$$

The IV estimates are presented in columns 5 to 8 of Table 4. The estimates suggest that the average treatment effects are robust to the handful of switches between training that we observed. The coefficient on the treatment B dummy is of a similar order of magnitude and is significant when additional regressors are included.

In the online appendix we explore two further measures of demand for insurance: number of policies purchased, and total value insured. We present ITT and IV estimates for these alternative outcomes, and find that trained farmers in training-B iddirs purchased more policies and insured a higher value of exposure.

We do not find that members of type B iddirs were more likely to make a joint insurance purchase decision or to share policies. These questions were only asked to those farmers that bought a policy, so the sample is quite small (74 farmers), and—perhaps because of the small sample size—we found no effect (results not reported). Very few farmers reported sharing policies.

These results suggest that leader training which frames insurance as something that can benefit the group and encourages sharing of payouts as a means to overcome some basis risk, increases demand. In the following sections we explore why this was the case, in particular, whether demand for index insurance was higher because θ was higher for those trained in type B iddirs.

4.2. Who purchased insurance

First, we examine who purchased insurance: was it all members of some iddirs or only selected members? As Table 3 indicates there are three types of farmers in our survey: leaders who took part in leader training sessions (either A or B), members who attended member-training sessions (A) and members who did not take part in any training. Thus far the analysis has highlighted that iddirs with a leadership that received training B had higher take-up than iddirs with a leadership that received training A. We now examine whether treatment B iddirs saw increased demand among trained or untrained members of the group and among the trained members, whether it increased demand more for leaders or members.

Selection into training was not random—iddir leaders were selected to attend the first training session and they chose who would attend the following session. The impact of training cannot be assessed, but it is informative to look at who increased their demand as a result of the messages given to leaders, whether this increased demand among leaders themselves, those they selected to attend training (either through who they selected or discussions they had with them) or those who had not attended training. Table 3 suggests that training that emphasized sharing encouraged take-up among members and leaders alike, but we test this formally in Table 5.

Table 5 underscores the finding that training is strongly correlated with demand. The results also indicate that when iddir leadership received training B, take-up among the trained in that iddir (both among the leadership and the ordinary trained members who had received training A) increased much more than take-up among the non-trained. In fact the results suggest that, among the non-trained, the type of training received by the iddir leadership did not affect demand. Increased take-up resulted solely from those trained—the leaders themselves and the ordinary members.

A further interaction of iddir leadership, receipt of training and iddir type shows that iddir leaders and ordinary members were not equally likely to increase demand. The small number of iddir leaders in our sample makes the estimate of the impact of training on iddir leaders imprecise, but the results suggest that the training had a larger impact on ordinary members than on iddir leaders (although the impact on iddir leaders was also sizable). It suggests that either the way ordinary members were selected by their leaders or the discussions that leaders had with these members encouraged higher take-up.

The fact that demand was concentrated among those that were trained, suggests that it is unlikely that iddirs made changes in their

Table 5
Estimating the impact of training on insurance purchases by iddir leaders, trained members and untrained members.

	(1)	(2)	(3) Trained members only
Iddir leader	0.354***	0.367***	
	(0.098)	(0.105)	
Trained ordinary member	0.238***	0.222***	
	(0.058)	(0.054)	
Training B * iddir leader	0.153	0.108	
	(0.144)	(0.148)	
Training B * trained ordinary member	0.198	0.235**	
	(0.126)	(0.112)	
Training B * untrained member	0.037	0.018	
	(0.034)	(0.035)	
Training B			0.186*
			(0.098)
Number allocated training	0.013*	0.012*	0.017
	(0.007)	(0.007)	(0.010)
Constant	−0.052	0.169	0.205**
	(0.034)	(0.106)	(0.080)
Basic characteristics	No	Yes	No
District fixed effects	No	Yes	No
Observations	290	288	172
R-squared	0.232	0.317	0.0508

Dependent variable is a dummy indicating whether insurance was purchased.
Standard errors corrected for clustering at the iddir level are in parentheses.
District and strata fixed effects are included but not shown.
Training B means that iddir leadership received training B.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

formal structure to accommodate more risk-sharing between all members of the iddir. If higher risk-sharing is explaining increased demand for insurance, it is as a result of risk-sharing among sub-groups within the iddir.

4.3. Group training was a better training

Before exploring the impact of training B on risk-sharing we test whether it had any other effects. A potential concern in our analysis is the possibility that training B might have been different in other ways, beyond the emphasis on the benefits of sharing. Whilst training A and B only differed in the framing and the discussion of how to make decisions in the last half hour of the training, we would like to test whether the different natures of the discussion within the session (or that resulted from the session) might have led to an enhanced understanding of the product.

In Table 6 we explore this possibility. We analyze the effect of training type on understanding of two aspects of the insurance that were emphasized in the training: the concept of millimeters and the concept of basis risk. We would expect understanding of both to be positively affected by training. However, if randomized training sessions did not differ in quality of training, respondents in type-B iddirs should not have a better understanding of these two issues than respondents in type-A iddirs.

To measure understanding of millimeters we asked whether farmers had ever heard of millimeters and how many millimeters were likely to fall in an hour of heavy rain. Using the combined response, we find that those that were trained were twice as likely to know about millimeters as those that were not trained. However, this could indicate that more knowledgeable farmers were being trained rather than that the training was effective.

We test differences across training types and find that the type of training had no effect on understanding (columns 1 and 2 of Table 6). Measuring whether respondents understood that basis risk exists is more difficult. We asked the respondent to consider a hypothetical situation in which he had bought insurance and experienced downside basis risk (experienced bad yields whilst the weather station recorded

Table 6
Estimating the impact of training on understanding of millimeters and basis risk.

	(1)	(2)	(3)	(4)
	Know millimeters		Understand basis risk	
Training B	0.039	0.034	0.049	0.064
	(0.065)	(0.056)	(0.068)	(0.067)
Number allocated to training	0.000	0.001	0.007	0.006
	(0.006)	(0.006)	(0.007)	(0.007)
Constant	0.300***	0.215*	0.663***	0.723***
	(0.054)	(0.120)	(0.060)	(0.127)
Basic characteristics	No	Yes	No	Yes
District fixed effects	No	Yes	No	Yes
Observations	289	287	291	289
R-squared	0.005	0.120	0.009	0.101

Standard errors corrected for clustering at the iddir level are in parentheses.
District and strata fixed effects are included but not shown.
Training B means that iddir leadership received training B.
*** $p < 0.01$.
* $p < 0.1$.

a good reading). We then asked the respondent to state whether or not he would purchase insurance again in the following year. If the respondent had understood that basis risk exists one could argue that his response would be less affected by the description of this scenario. We test this in columns 3 and 4 of Table 6. For both of these measures we find that the type of training received did not impact understanding on these two issues.

4.4. Discussion of insurance

In this section we test whether the message communicated to leaders in training B resulted in differences in the levels of discussions in iddirs assigned to training A or B. Whilst differences in post-training discussions are consistent with all mechanisms described, they would be particularly consistent with a story in which training B increased enthusiasm or increased risk-sharing among members.

The number of members the iddir was requested to select for training is a significant determinant of take-up in all specifications estimated thus far. Receiving training is the single largest determinant of whether or not an individual purchased insurance and the probability that an individual received training increased with the number of people the iddir was requested to select. However, there is another possible explanation for why demand increased with the number trained: if iddir members spoke with each other about the training after the training ended and if these discussions encouraged demand then being in an iddir in which more people were trained may have increased demand in this

Table 7
Estimating differences in risk-sharing between treatments (ITT).

	(1)	(2)	(3)	(4)	(5)	(6)
	Received gift or consumption loan		Received gift		Received consumption loan	
Training B	0.099*	0.075*	0.007	–	0.093*	0.071
	(0.057)	(0.045)	(0.049)	0.007	(0.054)	(0.045)
				(0.052)		
Constant	0.110***	0.398***	0.154***	0.130	0.088***	0.335***
	(0.025)	(0.118)	(0.033)	(0.082)	(0.021)	(0.107)
Basic characteristics	No	Yes	No	Yes	No	Yes
District fixed effects	No	Yes	No	Yes	No	Yes
Observations	291	289	291	289	291	289
R-squared	0.015	0.104	0.008	0.039	0.017	0.085

Standard errors corrected for clustering at the iddir level are in parentheses.
District and strata fixed effects are included but not shown.
Training B means that iddir leadership received training B.
*** $p < 0.01$.
* $p < 0.1$.

Table 8
Testing for differences in means between ordinary members selected for training by leaders who received training A and B respectively.

	Members of iddirs in which leader attended training A	Members of iddirs in which leader attended training B	Test of difference (p-Value)
Age	41.17	42.36	0.57
Gender (1 = female)	0.02	0.02	0.86
Can read (1 = yes)	0.71	0.64	0.51
Can write (1 = yes)	0.69	0.64	0.62
Education (years)	5.39	4.55	0.30
Born in this kebele (1 = yes)	0.96	0.95	0.80
Holds an official position (1 = yes)	0.31	0.33	0.85
Parents held official position (1 = yes)	0.13	0.26	0.10
Relatives hold official position (1 = yes)	0.56	0.52	0.76
Number of iddirs of which a member	2.41	2.48	0.71
Leader of other iddir	0.35	0.36	0.96
Log of land owned (timads)	1.09	1.29	0.55
Own a mobile phone (1 = yes)	0.35	0.36	0.96
Member of an eqqub (1 = yes)	0.15	0.07	0.25
Has a bank account (1 = yes)	0.02	0.05	0.42

manner. We test for the presence of this type of externality by looking at whether the number of people trained in an iddir had an impact on an individual's demand after controlling for receipt of training. We find that its significance is reduced, but it still had some impact with a p-value of 0.104 (results presented in column 3 of Table 5) indicating some positive externality resulting from the number of members being trained.

We further explore the effect of training type on how much trained farmers spoke to others about the insurance policies by examining survey responses on whether trained members spoke to others about the insurance and the number of people spoken to. Only farmers that were in the training were asked these questions, so the individual level regression is restricted to trained farmers. We find that all treatment variables are insignificant.

We also test whether awareness of non-trained farmers about the insurance policies being sold was higher in type B iddirs. This gives some indication of whether the increased discussions about the policies in type B iddirs between trained and non-trained farmers were resulting in higher awareness of others about the policy. We find that they do not. This suggests that the increased discussions in type B iddirs were not with non-trained farmers. This corresponds to the finding that type B training did not increase purchases among non-trained farmers.

Although there is some evidence of positive externalities from training members, we find little direct evidence of increased discussions among members.

4.5. Risk-sharing among selected members

Few untrained farmers purchased insurance, and training B did not encourage increased knowledge or demand of insurance among untrained iddir members. Thus, if training B increased demand by encouraging increased risk-sharing of risks not covered by the policy, it is likely that it was taking place initially among sub-groups within the iddir, and not the iddir membership as a whole.

If higher demand in type B iddirs is driven by increased awareness of Theorem 2, we would expect to see evidence of higher levels of risk-sharing in type B iddirs. Risk-sharing could take the form of more gifts or loans being received by iddir members to manage shortfalls in food consumption or other sources of income shocks (such as health shocks). We test whether individuals in type B iddirs were more likely to report receiving gifts from individuals or loans for food consumption or health expenses in the 12 months prior to the survey. Results for these tests are presented in Table 7.

We do find evidence of higher levels of gifts and consumption loans being received among members of type B iddirs, particularly consumption loans. The result could reflect two things: (i) that those who were more engaged in risk sharing (as evidenced by higher receipts of gifts and loans) were more likely to be selected for training by leaders in type B iddirs (and therefore included in our sample, given that we over-sampled, those who had been trained), or (ii) that the intervention encouraged increased risk sharing among selected members. Either mechanism is consistent with Theorem 2. Given that most of the reference period fell prior to the intervention (10 of the 12 reference months), it is perhaps most likely to be the selection that is driving the difference.

To further test for selection, we compare characteristics of those selected for training by B-leaders to those selected for training by non-B leaders. First, we use the same variables used in Table 1 which cover aspects of human, social and physical capital that will not have been affected by the intervention. Results are presented in Table 8 and show that there are no observable differences.

However, other characteristics such as an individual's preference for risk, or an individual's predisposition to engage in risk-sharing, may be more likely to affect whether or not an individual was selected by the iddir leadership for training. Without pre-intervention measures of these characteristics it is hard to ascertain whether or not this was the case. However, we present an analysis of post-intervention measures of these characteristics in Table 9. We test for differences in risk preference, time preference, and beliefs about the honesty and trustworthiness of others. We find that individuals selected for training in group B iddirs were more likely to believe others to be honest and trustworthy. These differences in attitudes suggest that individuals in group B iddirs may be more likely to share risk.

Although no difference in a number of observable characteristics was found, these attitudinal differences could reflect differential selection across training types, but equally we cannot rule out the possibility that this difference is itself an impact of the intervention.

Finally, to explore evidence consistent with the hypothesis that increased risk sharing caused increased insurance purchases in type B iddirs we look at the degree of correlation between purchases of members in the same iddir. If the difference in training had an effect by increasing risk sharing we may expect that take-up would not just be higher among members in training B iddirs, but that training would be more correlated among members in training B iddirs. If the payout will be dissipated via the demands for risk-sharing of the network, a given member has more of an incentive to purchase insurance if others do so as well. In contrast, take-up in iddirs where risk sharing was not encouraged may be more of an individual decision.[8] The variation in take-up that is explained by variation across iddirs is much higher in

[8] We are grateful to a reviewer for pointing this out.

Table 9
Estimating differences in attitudes between treatments (ITT).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Time preferences		Risk preferences		Believes others to be honest		Believes others to be trustworthy	
Training B	−19.229	−20.753	−0.052	−0.033	0.227	0.251*	0.266	0.307**
	(18.699)	(16.650)	(0.155)	(0.162)	(0.181)	(0.149)	(0.174)	(0.138)
Constant	213.889***	231.859***	1.215***	1.102***	4.963***	4.530***	4.934***	4.513***
	(15.605)	(33.938)	(0.097)	(0.266)	(0.129)	(0.298)	(0.124)	(0.290)
Basic characteristics	No	Yes	No	Yes	No	Yes	No	Yes
District fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	286	284	291	289	291	289	291	289
R-squared	0.016	0.056	0.008	0.043	0.015	0.078	0.019	0.080

Standard errors corrected for clustering at the iddir level are in parentheses.
District and strata fixed effects are included but not shown.
Training B means that iddir leadership received training B.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

type B iddirs than in type A iddirs (the adjusted R-squared of a regression of take-up on iddir dummies is 0.09 in type B iddirs and −0.03 in type A iddirs). We test whether there was increased variance of take-up among training B iddirs compared to training A iddirs. Given that we only surveyed some members of each iddir we are somewhat limited in the extent to which we can test this, but we do find that the variance of demand is marginally higher among training B iddirs. The standard deviation of demand among training B iddirs is 0.30 whilst the standard deviation of demand among training A iddirs is 0.24. A test that the standard deviation of take up in training B is higher than the standard deviation of take up in training A has a p-value of 0.11.

5. Conclusions

In this paper, we report the results from a first attempt to market weather insurance products to informal risk-sharing groups, and find that demand among trained members was substantially increased when groups were exposed to training that encouraged sharing of insurance within groups.

We propose that one mechanism for this higher level of take-up may come from the ability of groups to mitigate some of the basis risk inherent in these products. We provide a theoretical proof that shows that, under quite general conditions, risk-sharing and index insurance are complementary with increased access to one driving up demand for the other, so that providing index insurance may crowd in informal risk-sharing. We also show that this is quite different to the relationship between risk-sharing and indemnity insurance, which are well-known to be substitutes.

We found that leaders that had received training on how policies and payouts could be shared among group members encouraged more members to attend a subsequent training session. Additionally, when the leadership was trained on sharing policies and payouts, increased risk-sharing was reported among members. The results also suggest that if farmers are increasing informal risk sharing as a result, it is being done in small groups of selected farmers.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jdeveco.2013.09.006.

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