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The introduction of formal insurance and its effect on redistribution

Abstract

Transfers motivated by altruism, norms of giving, and guilt play an important role in supporting individuals who suffer losses due to risk. We present empirical evidence from an artefactual field experiment in Ethiopia in which we introduce formal insurance in a setting where donors make redistributive transfers to anonymously paired recipients. We find that donors reduce their transfers to recipients who don't take-up insurance, and that this effect is larger for donors who hold the ex ante belief that the recipient is more likely to take-up insurance. The findings are consistent with a model of a norm of giving where donors feel guilty for deviating from the norm. The feelings of guilt decline with the expected social distance, that is revealed by the recipients' observable insurance uptake decisions. The model highlights how the introduction of formal insurance may erode norms of giving and lead vulnerable groups to face more volatile consumption.

JEL-Codes: D640, D910, G220, O160, O170.

Keywords: formal insurance, transfers, norms of giving, guilt, social distance.

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I Introduction

Private transfers play an important role in supporting individuals and households who suffer income losses due to various forms of risk, especially in the absence of well-functioning insurance markets (Townsend, 1994; Samphantharak and Townsend, 2018). While the literature has traditionally assumed that such private transfers are motivated by reciprocity and self-enforcing contracts (Kimball, 1988; Coate and Ravallion, 1993; Kocherlakota, 1996), recent empirical work finds that altruism, norms of giving, and guilt are important drivers (Jakiela and Ozier, 2015; Squires, 2017; Barrett et al., 2018).[1] But guilt/altruism-based transfers are conditional on social distance, such as the similarity of risks a donor and recipient are exposed to, the similarity of effort they choose to expend, or similarity of identity or class (see Brock et al. (2013); Cappelen et al. (2007); Chen and Li (2009); Charness and Gneezy (2008) respectively). When a new market is introduced, subsequent purchase decisions may reveal information about social distance between donors and recipients. As a consequence donors may become less altruistically minded or feel less guilty for not transferring, leading to the erosion of norms of giving. In contexts where individuals face heterogenous private constraints to adopting products, for example due to a lack of liquidity or low levels of financial literacy (Casaburi and Willis, 2018; Ambuehl et al., 2018), the introduction of a new market and subsequent reduction in redistributive transfers, may lead some households to face more volatile consumption than before the market was introduced.

This paper investigates, theoretically and empirically, the effect of the introduction of formal insurance[2] with incomplete take-up on private redistributive transfers, defined as voluntary and non-reciprocal transfers, to individuals suffering income losses.[3] We first present evidence from an artefactual field experiment (Harrison and List, 2004) in rural Ethiopia where farmers make transfers to recipients anonymously drawn from either within or outside of the donor's own community. Preceding transfer decisions, recipients may or may not be offered insurance, and if offered, may or may not take it up. We then develop a simple theory where individuals

[1] Limited commitment (without altruism) and hidden income prevent transfers from being self-sustaining (Foster and Rosenzweig, 2001; Albarran and Attanasio, 2003; Kinnan, 2017)

[2] Formal insurance is increasingly introduced into such emerging markets and these markets are becoming the main source of premium growth to the international insurance industry (Federal Insurance Office, U.S. Government, 2013; Swiss Re Institute, 2017).

[3] This is distinct from studies that have investigated crowding-out of reciprocal transfers that are the result of (self-enforced) contracts in informal or mutual risk-sharing arrangements (Arnott and Stiglitz, 1991; Attanasio and Ríos-Rull, 2000; Albarran and Attanasio, 2003; Mobarak and Rosenzweig, 2012; Dercon et al., 2014; Berg et al., 2017).

transfer because they experience guilt when they deviate from a social norm of giving (akin to a kinship tax (Jakiela and Ozier, 2015)). This norm will be less adhered to after the introduction of formal insurance reveals similarity or distance (social distance) in risk behaviour between prospective donors and recipients.[4] The first contribution of this paper is that we show that it is not the action of a recipient *per se* (not reducing risk, not expending effort) that motivates a donor to reduce transfers (as "punishment"), but rather the combination of the recipients' action with the donor's own attitude towards this action (e.g. *'If I typically don't expend a lot of effort, I am not going to reduce transfers to someone who is also not expending a lot of effort'*).[5] Our second contribution is that we show that in a context where guilt/altruism are important drivers of a norm of giving (Platteau, 2015; Jakiela and Ozier, 2015; Squires, 2017; Barrett et al., 2018), donors may use a motivated reason, such as social distance that is revealed through the introduction of a new market, to reduce guilt and justify 'not-giving'. This suggests that motivated reasoning might be another cause, in addition to 'hidden income' (Jakiela and Ozier, 2015), for expected future informal transfers to be unreliable/unpredictable. Our final contribution is that we demonstrate, by means of a welfare analysis, that the introduction of formal insurance, may reduce equilibrium transfers through its effect on individuals' willingness to make altruism/guilt-based transfers, and not only through its effect on self-enforced reciprocal transfers (Arnott and Stiglitz, 1991; Mobarak and Rosenzweig, 2012). The effect on altruism/guilt-based transfers may imply that the benefits of introducing a new market may be very unevenly distributed and even negative for some vulnerable groups.

We conduct the artefactual field experiment with farmers from rural communities in Ethiopia who are randomly and anonymously paired with another participant, drawn either from their own community or from another community. The chosen population – Ethiopian farmers – is suitable for the current study as redistributive transfers to support peers who suffer income losses are prevalent in this population. Moreover, these farmers have not yet been exposed to formal insurance that protects against risk. The individuals in each pair are randomly assigned to the role of donor or recipient. While the income of donors is certain, the income of recipients is subject to the risk of a loss. In the baseline condition of the experiment, recipients have no agency

[4] We remain agnostic about the specific driver of risk behaviour that is revealed, e.g. attitudes to risk, understanding of the risk decision context, performance risk, or access to precautionary savings.

[5] Previous literatur demonstrates that donors, on average, reduce transfers in reaction to recipient's actions (not expending effort, taking risk) and has often attributed this to "punishment" (Cherry et al., 2002; Cappelen et al., 2007, 2013; Brock et al., 2013))

over the risk to their income. In the treatment condition each recipient is offered actuarially fair and complete insurance. She then has the choice, in private, of whether to accept or reject this offer. In the baseline condition, donors are asked *ex ante* if and how much they want to transfer to the recipient in case the recipient experiences a loss. In the treatment condition, donors are asked *ex ante*, without knowing the actual insurance decision by the recipient, if and how much they want to transfer in the case where 'the recipient purchased insurance and experienced a loss' and the case where 'the recipient did not purchase insurance and experienced a loss'.

The anonymous one-shot nature of the experiment delivers the focus on transfers that do not have an expectation of reciprocity. A lack of significant differences between transfers to recipients from the donor's own or another community suggests that donors do not perceive their transfers in the experiment as occurring within a broader local network, further supporting the interpretation that transfers are non-reciprocal. In real-life settings it will be difficult to distinguish to what extent transfers are motivated by guilt/altruism or reciprocity, and this will likely vary depending on how tight-knit and stable a local community is. The purpose of our study is to demonstrate that it is not only reciprocal transfers that are crowded out when a new market is introduced, but also altruism/guilt-based transfers, which the literature demonstrates are a substantial share (Alger and Weibull, 2010; Platteau, 2015; Jakiela and Ozier, 2015; Squires, 2017; Barrett et al., 2018). All pairs play both the baseline and the treatment arm, allowing transfers in the different arms to be compared while controlling for individual and pair-specific characteristics. This enables us to understand how decisions by recipients to reject an opportunity to reduce risk to their income affects the transfers made by donors with different characteristics. The experiment is also designed in such a way that the expected income to the recipient is the same across all arms. This facilitates the attribution of differences in transfers directly to the decision by the recipient.[6]

We report four main findings from the experiments. First, we find that while insurance take-up is high, it is not complete. Second, we find that donors are heterogenous in their expectations about recipients' insurance decisions, despite the fact that they are randomly and anonymously teamed up to someone from their own community; this implies some for of belief bias that varies systematically with the donors' own characteristics. Third, we find that donors transfer less to recipients when the latter reject insurance compared to when they are not offered any

[6]Preventing ex-ante fairness concerns from explaining differences in transfers (Brock et al., 2013; Krawczyk and Le Lec, 2016)

insurance, despite the fact that before-transfer income in both treatment conditions is the same. This implies that there is something about the insurance decision that is driving the transfer reduction. Finally we find that the transfer reduction by donors to recipients who failed to take up insurance and experience a loss is larger for donors who have a stronger *ex ante* belief that the recipient would take up insurance. This suggests that donor types who have a stronger *ex ante* belief that the recipient is more similar to themselves and who subsequently receive information that reveals more social distance than they anticipated, reduce their transfers relatively more. We note that people in a local community are typically assumed to have fairly good information about each other, and many asymmetric information problems in formal markets are overcome by making use of this information (Banerjee et al., 1994; Ghatak and Guinnane, 1999). We assume that there is still a degree of asymmetric information remaining, even in local communities, of which the introduction of a new market and subsequent purchase decisions can reveal some.

In order to explain the findings of the experiment, we develop a model of a local economy where individuals interact in pairs, face income risk, and make transfers to each other. There exists a social norm of giving, e.g. a social expectation that an individual who does not suffer an income loss should share some of her income with a partner who does.[7] Due to the norm being internalized, an individual who deviates from the expected transfer will experience a disutility in the form of guilt or shame. At the heart of the model is an assumption of privately observed unidimensional individual heterogeneity in type (where type can proxy for literacy, poverty, or credit constraints), and weaker feelings of guilt towards peers who are more dissimilar, a form of discrimination based on "social distance" (Becker, 1957; Fershtman et al., 2005; Ahmed, 2007; Feld et al., 2016). With heterogeneity in types also driving the individuals' observable insurance uptake decisions, the model captures the notion that the introduction of a new market makes salient the underlying social differences in the local population and enables donors to modify their transfers in light of observable type-related take-up behaviour of the recipients.

Our model has four core assumptions. Firstly, there is heterogeneity in the local population; an individual's type is private information and high types have a high cost of taking up insurance. Secondly, each individual engages with another anonymous member ("partner") drawn randomly from the local population. All individuals experience guilt towards their anonymous partners if they deviate from the expected transfer, but more strongly so towards closer types. Thirdly,

[7]The proof in the Online Appendix shows that the same results are obtained if we assume transfers are driven by altruism, rather than driven by guilt from deviations from a norm of giving

a false consensus bias implies that all individuals believe the type distribution to be closer to themselves than it actually is. Finally, when insurance is offered, each individual observes the partner's take-up decision. After characterising the equilibria with and without available insurance, we briefly consider welfare implications and conclude that – based on the model and the empirical evidence – the benefits generated by the introduction of a formal insurance market may be very unevenly distributed and may even be negative for some vulnerable groups.

Our work naturally connects to a literature on transfers in mutual or informal risk-sharing networks that allow individuals to smooth consumption in the face of risk (Coate and Ravallion, 1993; Foster and Rosenzweig, 2001; Townsend, 1994), but may also imply a social taxation on income (Platteau, 2015; Jakiela and Ozier, 2015; Squires, 2017; Barrett et al., 2018). In this literature, private transfers are modelled as reciprocal, either through enforceable contracts or via self-enforcing arrangements. Crowding-out occurs in this literature because the reciprocal transfers and the formal insurance both cover the same losses with formal insurance being preferred over transfers (for example because the reciprocal transfers are faced with limited commitment (Albarran and Attanasio, 2003) or because there is hidden income (Kinnan, 2017)). This literature also shows that if the process of crowding-out leads to lower risk coverage, for example because the formal insurance is incomplete, does not cover all risks, or excludes certain customers, this may lead to welfare reductions. We show that the introduction of formal insurance may also crowd-out non-reciprocal transfers, but through an alternative mechanism: when transfers are non-reciprocal and some preference or norm exists that motivates transfers, the availability of insurance and subsequent insurance decisions may reveal social distance between donors and recipients and as such provide donors with a motivated reason to not feel guilty for not transferring. The mere availability of insurance may be sufficient to lead to a reduction in private redistributive transfers to those with economic losses and lead to reductions in welfare because those who face constraints in taking-up insurance receive fewer transfers.

This paper also links to a literature on fairness and donor transfers to recipients who are responsible for their outcomes as a result of their effort and risk-taking decisions. In this literature, expending less effort and refraining from reducing risk-exposure leads, on average, to lower transfers from donors. This is typically explained by assuming that those who are expending low effort (Cherry et al., 2002; Cappelen et al., 2007) or those who don't protect against risk (Cappelen et al., 2013; Brock et al., 2013; Krawczyk and Le Lec, 2016; Lenel and Steiner, 2017) are 'punished' for not taking responsibility for their outcomes. We show that it is not the action of a recipient per se (not reducing risk, not expending effort) that motivates a donor to reduce transfers, but rather the combination of the recipients' action with the donor's own attitude towards this action. As such the action reveals how similar or different the recipient is from the donor, thus revealing social distance. The assumption of social-distance conditioned transfers has support in the literature (Charness and Gneezy, 2008; Rachlin and Jones, 2008; Goeree et al., 2010; Tajfel, 1970; Fowler and Kam, 2007). As such, rather than an action-contingent motivation, a social-distance contingent model is based on well-defined and stable preferences, thereby providing a solid foundation for any potential welfare analysis.

The paper is organized as follows. In Section 2 we explain the experimental design. In Section 3 we discuss the descriptives, and in Section 4 the results. In Section 5 we present the model and investigate welfare implications. Section 6 concludes.

II Experimental Design

For the field experiment, 378 farmers were selected from 16 *Iddir* from farming communities in rural Ethiopia. An *Iddir* can be described as an association made up by a group of individuals who are connected by ties of family, friendship, geographical area, jobs, or ethnic group (Mauri, 1987: 6-7). The objective of an *Iddir* is to provide mutual aid and financial assistance in case of emergencies. The 16 *Iddir* were selected from seven villages from three administrative regions in Tigray, one of the Northern provinces of Ethiopia. Each *Iddir* has a membership of between 100 and 200 farmers.

In each farming community and per *Iddir* one or two sessions were played with between 20-24 farmers (18 sessions in total). The sessions were organised in buildings that would typically be used by local farmer associations to hold meetings, and were at walking distance for the farmers. Farmers were seated in private portable cubicles for a maximum period of three hours. In these sessions the farmers received the instructions for the experiment at the group level. Per session, farmers were anonymously and randomly teamed-up in two person groups leading to 189 pairs. Half were teamed up with an anonymous other not from their own *Iddir* and half were teamed up with a farmer from their own *Iddir*. In the latter case they were informed that the other individual was from their own *Iddir* but they would otherwise remain anonymous. During the recruitment phase farmers were informed that they were eligible to participate in a survey and an experiment in which they would be teamed up with someone else and would be asked to make decisions about risk, insurance, and transfers. They were informed that they would receive a base-payment of 50 Ethiopian Birr (50 ETB; 2.5 USD) irrespective of the outcomes of their own or the decisions of the others in the experiments. They were also informed that they would be able to earn an additional amount between 0 and 110 ETB depending on the decisions they and others would make in the experiments. Farmers were also informed that the total participation time, including the experiment, the survey and the payment would not be more than three hours. The incentives in the experiments reflected a daily wage for unskilled labour, ranging between 50 and 150 ETB, during the timing of the experiments and were thus substantial.

The players' roles and the income process

Subjects were informed that they would be randomly assigned to play a role of "i" or "j". The role of i can be considered as "donor", the role of j can be considered as "recipient".[8] Each donor i was provided with a certain income of $y_i = 100$ ETB. In contrast, the income for each recipient j was uncertain as they faced an individual risk of a negative income shock, $s_j \in \{0, 1\}$. A negative income shock, $s_j = 1$, would occur with probability $p = 5/12$ and the recipient's income would then be reduced by 72 ETB. The recipient's income would thus be $y_j \in \{28, 100\}$ with $E[y_j] = 70$ and $Var(y_j) = 1260$.

The income realization of the recipient was arrived at through a two-stage process designed to mimic the process whereby weather realisations determine the probability of crop losses. This structure was deliberately chosen as it best reflected the farmers' experience of losses to agricultural production and thus to enhance subjects' understanding. In the first stage "weather", $f_j \in \{0, 1\}$, was simulated by a draw from an envelope that contained four tokens, three blue tokens representing "rainfall" ($f_j = 0$) and one yellow token representing "drought" ($f_j = 1$). In the second stage, the "crop loss" realization s_j was simulated using two different coloured dice – a red and a white – with different probabilities of loss. If, in the first stage, a blue "rainfall" token was drawn ($f_j = 0$), in the second stage the red dice – with a one-third probability of loss – would be used. If, in the first stage, a yellow "drought" token was drawn ($f_j = 1$), in the second stage the white dice – with a two-thirds probability – of loss would be used.

[8] In the explanation of the experiment to subjects, their roles were only referred to as i and j, not "donor" and "recipient". This was done to prevent an effect of expectations about roles on behaviour.

Hence indeed the probability of an individual loss for recipient j was

$$p \equiv \Pr\left(s_j = 1\right) = \sum_{f \in \{0,1\}} \Pr\left(f_j = f\right) \Pr\left(s_j = 1 | f_j = f\right) = \frac{3}{4} \times \frac{1}{3} + \frac{1}{4} \times \frac{2}{3} = \frac{5}{12}. \qquad (1)$$

Insurance offers

A private lottery with probability of 1/2 for the recipient determined if she was offered an actuarially fair and complete insurance contract. Hence, this lottery determined if she played the baseline condition of the experiment or the treatment condition. In the baseline condition the recipient received no insurance offer and her income y_j would hence be either 28 or 100 with probability $p = 5/12$ and $1 - p = 7/12$ respectively as outlined above.

In the treatment condition, the recipient received an offer of insurance and then had to decide whether to reject or accept, $z_j \in \{0, 1\}$. If she rejected the offer ($z_j = 0$) she would face the same risky income as in the baseline treatment, whereas if she accepted the offer ($z_j = 1$) her uncertain income was replaced by the certain income of $E[y_j] = 70$. The certain income would be arrived at via the recipient paying a premium equal to the expected loss (30) and receive a claim payment equal to the size of the loss (72) in case of a loss. An endowment equivalent to the insurance premium (30) was given to j before the experiment started so they had money to pay for the insurance premium. There was no direct cost of taking up insurance, so the rational decision for a risk averse individual (in the absence of any transfers) would be to take up the insurance.

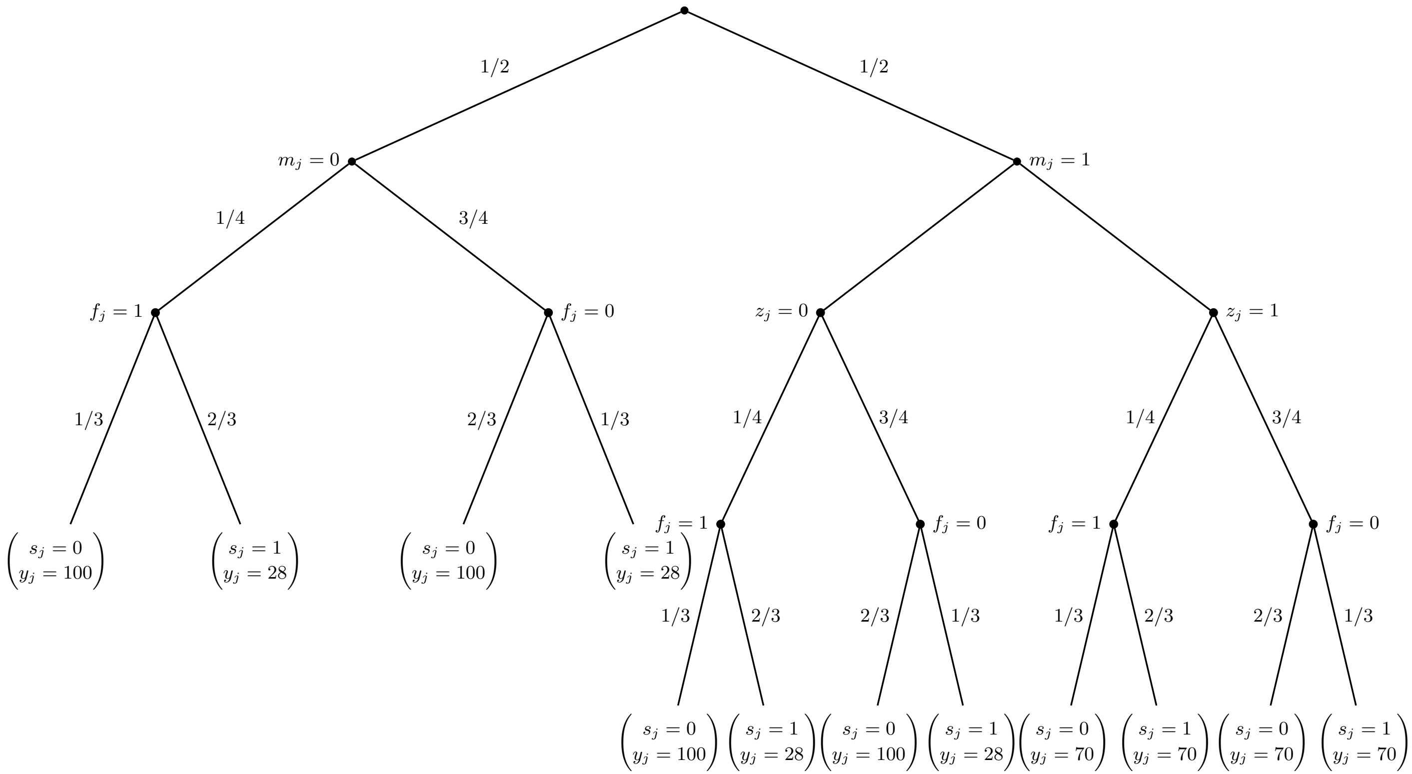

Figure 1: The income generating process for the recipient

Note: Where nature moves, probabilities are presented next to the branches of the tree. The states are presented at the nodes of the tree. Nature first decides, with a probability of 1/2, if the recipient j receives an insurance offer ($m_j = 1$) or not ($m_j = 0$). If offered insurance, the recipient then decides whether to accept ($z_j = 1$) or reject ($z_j = 0$) the offer. Nature then generates the recipient's income loss/no-loss state in a two-stage process. In the first stage – representing weather – a "drought" ($f_j = 1$) occurs with probability 1/4 whereas "rainfall" ($f_j = 0$) occurs with probability 3/4. In the second stage, the actual crop realization is drawn with a weather-contingent probability. In the case of drought, the probability of a crop loss was $Pr(s_j = 1|f_j = 1) = 2/3$ whereas in the case of rainfall the probability of a crop loss was $Pr(s_j = 1|f_j = 0) = 1/3$. If the recipient was uninsured – either due to not having received an insurance offer ($m_j = 0$) or due to having rejected it ($m_j = 1$ but $z_j = 0$) – her payoff in the loss state ($s_j = 1$) is 28 whereas her payoff is 100 in the no-loss state ($s_j = 0$). If she is insured ($m_j = 1$ and $z_j = 0$) her payoff is 70 irrespective of the realized state.

Transfers by donors

Without knowing if j received an insurance offer and, if she did, what her take-up decision was, the donor i was asked to specify three strategic conditional transfers (strategy method: see Selten (1967) and Brandts and Charness (2011)), τ_i^b, τ_i^0 and τ_i^1, each paid to j conditional on j experiencing an income loss $s_j = 1$, but differing with respect to the insurance offer and decision.[9] The first transfer, τ_i^b, would be made in the baseline case where j was not offered any insurance, $m_j = 0$. The second transfer τ_i^0 would be made in the event that j was offered insurance but opted not to take it up $z_j = 0$, and finally τ_i^1 would be made in the event that j was offered insurance and took it up $z_j = 1$. We will hence refer to the three conditions as the "baseline", "rejected insurance" and "accepted insurance" condition respectively.

The final payoffs to i and j were determined by nature's draw of the insurance offer, j's take-up decision if offered, the realisation of s_j and hence y_j, and the relevant transfer decision by i. Before starting the actual game, subjects received a central explanation and an individual explanation by their enumerator with a schematic representation of the experiment as shown in Figure B.1 in the Online Appendix. Farmers answered ten questions about the payoffs and probabilities in the game. The understanding was generally high, with more than 80% of subjects answering ten questions correctly. Expectations of real life weather and crop outputs were elicited in the survey after the experiments to control for framing effects. Robustness tests show that they do not effect results.

III Descriptives

Sample characteristics

All subjects in the sample are a member of at least one *Iddir*. 97% of the sample makes fixed monthly contributions to the *Iddir* of, on average, 6.49ETB, which is part of the Memorandum of Understanding (MoU) of membership to the *Iddir*. In addition, 35% of subjects make ex-post transfers to peers when they experience losses, irrespective of their monthly fixed contributions. These private ex-post transfers to peers in case of losses are 69.71ETB and subjects report that they themselves have received financial support from the *Iddir*, on average, three times. This

[9] The donor was not asked how much she wanted to transfer for the states where j did not experience a loss. Even though the donor might have wanted to make a transfer, it was decided to keep the number of decisions to a minimum to reduce cognitive load. We are most interested in the comparison of the states where j experienced a loss as this is the typical state where redistributive transfers are made.

shows that within the *Iddir* transfers to individuals who experience losses occur both on the basis of ex ante agreed contributions in the form of insurance, as well as on the basis of ex post transfers in cases of losses.

Table 1 shows measures of key demographic and farm characteristics elicited for the baseline sample of donors and recipients. All individual and farm characteristics, except for the number of adults in the household and the farmer's frequency of experiencing $25-50\%$ crop loss are balanced across donors and recipients. Out of all respondents 39% were female. All were farmers who owned on average 3.8 units of livestock and 0.61 hectares of farm land. Only 24% had access to irrigation. 46% of the farmers were literate, and 55% had received no education, making it likely that a substantial fraction of the respondents is insufficiently financially literate to fully comprehend the details of an insurance product. The 25-50% crop loss probability was on average 21%. This was elicited by asking *How many years out of the last ten years did you experience* $25-50\%$ *crop loss?* .

To assess subjects' risk preferences farmers played a simple incentivised ordered lottery selection experiment adopted from Binswanger (1981). Subjects were asked to make a choice between six lotteries, with a fixed probability of 1/2, in the gain domain. The available options, denoted $\{0, ..., 5\}$, correspond to increasing levels of risk aversion, starting at risk neutrality (0) and going to extreme risk aversion (5). For simplicity, we will use this measure in its original discrete ordered form and refer to simply as "risk aversion". Further details are provided in Table B.4 in the Online Appendix.

Actual and expected insurance take-up behaviour

Out of all 189 recipients 49% (94 recipients) received an insurance offer $m_j = 1$ and out of those 91% decided to take up the insurance, $z_j = 1$. Donors' beliefs about insurance take-up by the paired recipient were also elicited. To measure these beliefs each donor was asked: *How likely do you think it is that the recipient chose to take-up insurance if offered?* The donor was given ten coins and asked to use the ten coins to indicate her belief. She was told that ten coins reflected a belief that it was "very likely" that the recipient took up insurance, and zero coins reflected a belief that it was "very unlikely" that the recipient took-up insurance. The distribution of the answers of the donors $b_i \in \{0, 1, ..., 10\}$ is presented in Figure 2.

We will use that the scaled version of b_i – after dividing by 10 – falls in the unit interval and represents an increasing belief about uptake by the recipient. Hence we will refer to

Table 1: Descriptives and balancing test

	All	**Recipient**	**Donor**	**t-test**	**N(All)**
Demographics					
Female	0.39	0.40	0.39	0.15	365
Age in years	43.08	42.11	44.04	-1.56	365
Married	0.81	0.82	0.80	0.64	365
Number of adults in household	2.11	1.71	2.51	-4.84***	365
Number of children in household	3.17	3.28	3.07	1.25	365
Literate	0.46	0.48	0.43	0.99	365
Education	1.89	1.97	1.81	1.09	356
No education	0.55	0.53	0.57	-0.73	356
Primary complete	0.33	0.34	0.31	0.52	356
Secondary or more	0.12	0.13	0.12	0.36	356
Farm characteristics					
Farmer	1.00	0.99	1.00	-1.00	362
Tropical Livestock Units	3.78	3.91	3.66	0.66	365
Land size in Tsemdi	2.44	2.45	2.43	0.10	376
Farm land irrigated	0.24	0.25	0.22	0.52	365
Probability of loss own farm $25-50\%$	0.21	0.23	0.20	1.96*	365
Risk attitudes					
Riskaversion	3.00	3.20	2.83	1.50	224

Note: "Education" is a categorical variable from "0" to "8" with "0" being no education, and "8" being university. "Tropical Livestock Units (TLU)" is a weighted count of the number of livestock. One "Tsemdi" is 0.25 hectares. "Probability of experiencing $25-50\%$ crop loss" reports the answer to the question *How many years out of the last ten years did you experience* $25-50\%$ *crop loss?*, divided by ten. "Risk aversion" is a categorical variable from "0" to "5" with "0" being risk neutral and "5" being the most risk averse (See Table B.4 in the Online Appendix for further details). Lower sample sizes reflect that observations for that variable are missing. Risk aversion has a reduced number of observation because the ordered lottery selection experiment used to elicit risk preferences was not conducted for the first 7 out of 18 sessions. Columns 2 and 3 give the means for the "recipients" and the "donors" respectively. Column 5 presents the test statistic for the null hypothesis that the mean in the donor group is equal to the mean in the recipient group. Significance levels $p < 0.10^{*}$, $p < 0.05^{**}$, $p < 0.01^{***}$.

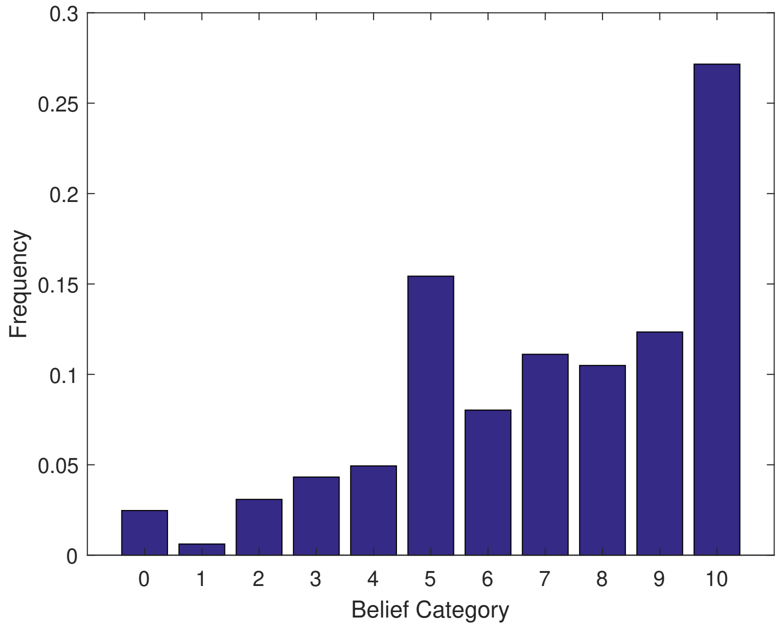

Figure 2: Donor's belief about the likelihood that the recipient took up insurance when offered

Note: Donors were asked for their belief about how likely it was that recipient with whom they were randomly and anonymously paired would take up insurance if offered. Responses were in 11 categories, $b_i \in \{0, 1, 2, ..., 10\}$, with 0 representing "highly unlikely" to 10 representing "highly likely". The figure depicts the distribution of reported beliefs among the 189 donors.

$b_j/10$ as measuring donor i's belief about the insurance uptake decision z_j of her randomly and anonymously allocated partner (if offered), and denote this $E_i[z_j|m_j = 1]$.

Table 2 presents regressions of both the binary insurance take-up decision by the recipient (column 1) as well as the donor's belief about take-up (column 2) on individual demographic and farm characteristics. Literacy, eduction, the number of tropical livestock units, land size, and the probability of loss are positively and significantly correlated with the insurance take-up decision by the recipient. Literacy, education, probability of loss, and irrigation of farm land are positively and significantly correlated with the donor's belief while the number of adults in the households is negatively and significantly correlated with the donor's belief. Since uptake is a binary indicator variable, while the belief variable falls in the unit interval, the coefficients are in principle comparable in size.[10] We also run a squareroot LASSO with all demographics and farm characteristics as potential predictors of the recipient's take-up decision and donor's belief about the take-up decision by the recipient respectively. For the recipient's take-up decision the squareroot LASSO selects "Married", "Number of adults in household", "TLU", "Farm land irrigated", and "Probability of loss own farm 25-50%" as significant predictors. For the donor's blief about the take-up decision by the recipient the square root LASSO selects "Literate", "Number of adults in household", "Farm land irrigated", and "Probability of loss own farm 25-50%" as significant predictors.

The most striking finding from these results is that there is a strong overlap both in terms of sign and magnitude of the covariates that are significantly correlated with both the recipient's actual take-up decision and the donor's belief about the take-up decision by their randomly and anonymously allocated recipient partner. These findings are strongly suggestive of a fundamental heterogeneity in the population that drives not only individual insurance uptake behaviour but crucially also an individual's expectation of uptake behaviour of others. The heterogeneity appears to relate to fundamental individual characteristics reflected in education/literacy and, possibly also, susceptibility to risk. In contrast, there is no discernible relationship between risk aversion on the one hand and either insurance take-up or beliefs about take-up on the other. The overlap between the correlates of take-up and of beliefs about take-up implies that individuals who are themselves more likely to take up insurance expect a higher average take up rate among random anonymous others. But as the average take up rate among random anonymous others

[10] We refrain, however, from testing formally for equality of coefficients. The outcome variables have a different nature, one is binary, and one is an interval variable so the error structure will, by definition, be different, making formal testing an inappropriate exercise.

cannot vary with the individual's own characteristics, this in turn would imply that beliefs are systematically biased. Specifically, it would imply that individuals expect others to behave more similar to themselves than they actually do. The notion that individuals tend to overestimate how similar others are to themselves is well-documented in the literature (see below) and will be a key ingredient in the model presented below.

To provide an additional test for this based on our data we use information about historical crop losses, and beliefs about crop losses of others and test if individuals who have a high likelihood of crop losses overestimate the likelihood of crop losses experienced by others[11] As noted above, as measure of own loss frequency the participants were asked the question: *How many years out of the last ten years did you experience* $25-50\%$ *crop loss?* In addition, they were asked what they perceived to be the average loss frequency within their *Iddir* using the question: *On average, how many years out of the last ten years did farmers in your Iddir experience* $25-50\%$ *crop loss?*[12] If subjects believe that others are more similar to themselves than they really are this would imply that individuals who experienced frequent losses relative to their peers overestimate the loss frequency among their peers.

To do so we computed the empirical distribution of loss frequencies in each *Iddir*, and each individual farmer's rank within that distribution. We then computed, for each farmer, the ratio of the empirical average loss frequency in the *Iddir* to the average loss frequency that she perceived. If farmers had a correct perception about the loss perception, this ratio would be unity. The results reported in Table 3 reveal a strong pattern: the more frequent an individual's own losses are relative to her peers, the more likely she is to overestimate the frequency of losses among her peers. For instance, individuals who were is in the top quarter of the frequency of losses within their *Iddir* were found to overestimate the frequency of losses among their peers by close to 80 percent on average. Conversely, those who had below median loss frequencies systematically underestimated the average loss frequency among their peers.

[11]Ideally we would have used historical information on insurance take-up decisions, and beliefs about insurance take-up by others. However, insurance has not yet been introduced in these communities.

[12]For both questions, the farmers were given 10 coins and told that each coin represented a year.

Table 2: Regressions of recipients' insurance take-up decisions and donors' beliefs about their paired recipient's take-up decision on demographic and farm characteristics

	Recipient take-up	**Donor belief**
	$z_j \in \{0,1\}$	$E_i(z_j \vert m_j = 1)$
Age in years	-0.002	0.000
	(0.003)	(0.001)
Literate	0.063*	0.055*
	(0.036)	(0.031)
Education	0.023**	0.025**
	(0.010)	(0.010)
Female	-0.041	-0.015
	(0.054)	(0.050)
Married	0.111	-0.008
	(0.096)	(0.052)
Number of adults in household	-0.022	-0.038***
	(0.028)	(0.013)
Number of children in household	0.010	-0.005
	(0.017)	(0.013)
Tropical Livestock Units (TLU)	0.014*	0.001
	(0.007)	(0.001)
Land size in Tsemdi	0.026*	-0.011
	(0.013)	(0.012)
Farm land irrigated	0.053	0.095**
	(0.063)	(0.046)
Probability of loss own farm $25 - 50\%$	0.020*	0.040***
	(0.012)	(0.014)
Risk aversion	-0.002	0.005
	(0.008)	(0.011)

Note: Note: Column 1 presents the regressions of insurance take-up of recipients $z_j \in \{0,1\}$ on each individual covariate separately. The number of observations in each regression is $N = 93$, except for the case of "Risk aversion" where the number of observations is $N = 55$ as the lottery selection experiment was not run in the first 7 out of 18 sessions (see the Online Appendix for further details). Column 2 presents the regressions of the donor's belief about the insurance take-up decision by the recipient. The number of observations in each regression is $N = 160$, due to some missing variables except for the case of risk aversion where $N = 108$ due the underlying lottery selection experiment not being run in the first 7 of the 18 sessions. The dependent variable in this case is derived from the categorical belief variable b_i (the distribution of which was illustrated in Figure 2) through dividing by 10. As the resulting variable falls in the unit interval with 0 representing "highly unlikely" and 1 representing "highly likely", we interpret the dependent variable as representing the donor's expected value of the recipient's take-up if offered, $E_i(z_j|m_j = 1)$. "Risk aversion" is a categorical variable from "0" to "5" with "0" being risk neutral and "5" being the most risk averse (See Table B.4 in the Online Appendix for further details). "Education" is a categorical variable from "0" to "8" with "0" being no education, and "8" being university. Clustering of standard errors in all regressions at the session level (n=18). Significance levels $p < 0.10^{*}$, $p < 0.05^{**}$,$p < 0.01^{***}$

Table 3: Ratio of perceived to actual loss frequency among *Iddir* peers by rank of own loss frequency within the *Iddir*

Own loss rank within Iddir	**Quartile** 1st	2nd	3rd	4th
Perceived/actual loss	0.81	0.89	1.20	1.79
frequency within Iddir	(0.07)	(0.06)	(0.09)	(0.07)

Note: A measure of "own loss" frequency was constructed based on the question: *How many years out of the last ten years did you experience* $25-50\%$ *crop loss?* Respondents were further asked about the average loss frequency among their *Iddir* peers throught he question: *On average, how many years out of the last ten years did farmers in your Iddir experience* $25-50\%$ *crop loss?* For each *Iddir* we rank the respondents in terms of the count of own losses and place them into quartiles. For each respondent we take the ratio of her perceived loss frequency among peer to the average reported own loss frequency of the other respondents from the same *Iddir*. The table gives the average ratio by the within-*Iddir* quartile of own losses for all donors ($N = 189$).

IV Results

Average transfer levels

The left hand of Figure 3 presents a histogram with 10 ETB bins of the transfers in each treatment condition. The blue bars show the distribution of the "baseline" transfers, τ_i^b, chosen by the donors for the case where the recipient received no insurance offer. The green bars show the distribution of the transfer τ_i^0 chosen by the donors for the case where the recipient rejected an offer of insurance. Finally, the yellow bars show the distribution of τ_i^1 chosen by the donors for the case where the recipient accepted an offer of insurance. A simple visual inspection indicates that the empirical distribution of baseline transfers first order stochastically dominates both the distribution of "rejected-insurance" transfers, and the distribution of "accepted-insurance" transfers. On top of this the the distribution of "rejected-insurance" transfers first order stochastically dominates the distribution of "accepted-insurance" transfers. In Table B.1 in the Online Appendix, the complete distributions are provided. Among the 567 observed chosen transfers by 189 donors there is only one violation of first order stochastic dominance.

The right panel of Figure 3 shows the mean and 95% confidence interval for each of the three transfers. The average transfer by donors to recipients in the case they are not offered insurance was close to 15 ETB. In contrast, the average transfer to recipients who reject insurance was only 10 ETB and the average transfer to recipients who accept insurance was further reduced to 5 ETB. The means are all statistically significantly different.

It is not surprising that the donors provide relatively smaller transfers to recipients who accept insurance: in this case both the donor and the recipient have certain incomes of 100 and 70 ETB respectively, so small transfers would be consistent with any norm of giving or altruism-based motive for income equalization. More striking is the substantial shift in transfers towards zero in the treatment condition where the recipient rejects insurance, compared to the baseline "no insurance offer" condition. In both treatment conditions the recipient has the same income prospect before transfers, so the donor's decision to reduce transfers is clear evidence that the recipient's insurance decision affected the donor's transfers.

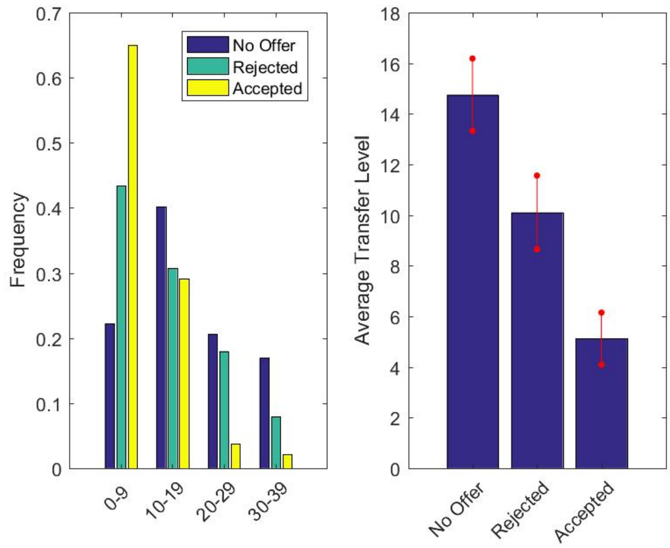

Figure 3: Mean and confidence intervals of donors' transfers

Note: The left panel gives the empirical frequency of observed transfer, within bins of 10, by treatment arm: the "baseline" transfer τ_i^b, the "rejected insurance" transfer τ_i^0 and the "accepted insurance" transfer τ_i^1. The right panel shows the mean, with 95% confidence intervals, of each transfer. The number of observations for each transfer is $N = 189$.

Figure 4 provides further details by plotting the empirical joint distributions of τ_i^b and τ_i^0 (left panel) and of τ_i^b and τ_i^1 (right panel). The marker size is proportional to the number of observations making that choice-combination. The solid red line is the 45-degree line while the blue dashed line in each figure illustrates the average ratio of transfers among donors making a positive baseline transfer $\tau_i^b > 0$. Focusing first on the "rejected insurance" transfer (left panel), among the donors who chose a positive baseline transfer, $\tau_i^b > 0$, the transfer τ_i^1 was on average close to 30 percent lower. The figure highlights that some donors maintained the same transfer, $\tau_i^0 = \tau_i^b$, while some donors substantially reduced their transfers, $\tau_i^0 < \tau_i^b$, often to zero; only a small number of donors increased their transfer. Turning to the "accepted insurance" transfer (right panel), the figure shows that more than half of all the donors offered no transfer to a recipient who accepted insurance, $\tau_i^1 = 0$. The "accepted insurance" transfer was, on average, 65 percent lower than the baseline transfer (among donors for whom $\tau_i^b > 0$), with only a few donors choosing $\tau_i^1 > \tau_i^b$.

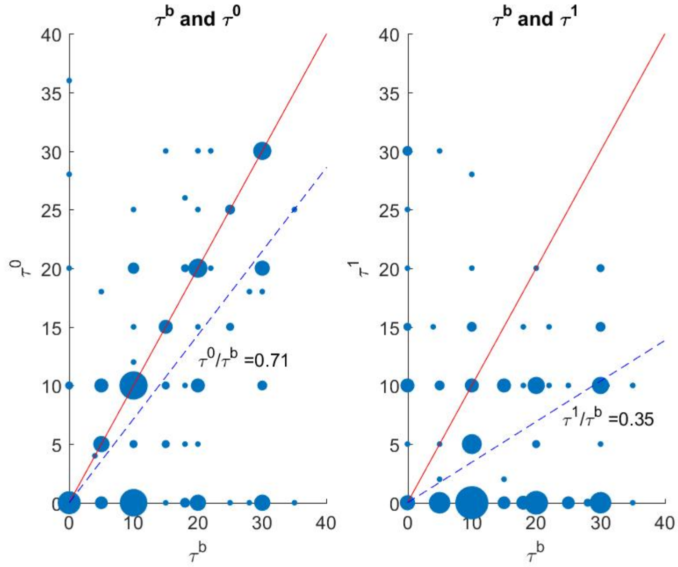

Figure 4: The empirical joint distributions of transfers

Note: The left panel plots the joint distribution of τ_i^b and τ_i^0. Marker size is proportional to the number of observations with that choice. The solid red line is the 45-degree line and the hatched blue line illustrate the average ratio of τ_i^0/τ_i^b (conditional on $\tau_i^b > 0$). The right panel plots the corresponding joint distribution of τ_i^b and τ_i^1.

As we observe all three transfers, τ_i^b, τ_i^0 and τ_i^1, for each of the 189 donors, our design automatically controls for – observable or non-observable – individual factors that might affect transfers chosen by a given donor.

Therefore we estimate the following fixed effects regression,

$$\tau_i^k = \alpha + \beta_0 I_i^{k=0} + \beta_1 I_i^{k=1} + \mu_i + \epsilon_i^k, \qquad k = b, 0, 1, \tag{2}$$

where τ_i^k is the observed transfer in ETB, I_i^k is a dummy indicator variable for the observed transfer being the "rejected insurance" transfer (τ_i^0) and the "accepted insurance" (τ_i^1) respectively, μ_i is a donor specific error term, and ϵ_i^k is the decision-specific error term. The constant α thus captures the average baseline transfer τ_i^b, after removing the individual fixed effects and β^0 and β^1 measure the average deviations of the tranfers given to recipients after rejecting/accepting

Table 4: Fixed effects regressions of transfers on treatment condition

	(1)	(2)	(3)
Baseline (α)	14.84	14.84	15.31
	(0.49)	(0.49)	(0.49)
Ins. Rejected (β_0)	-4.71***	-4.30***	-0.34
	(0.77)	(1.03)	(2.71)
Ins. Accepted (β_1)	-9.68***	-10.32***	-10.63***
	(0.92)	(1.09)	(3.44)
Own *Iddir* × Ins. Rej.		-0.80	
		(1.54)	
Own *Iddir* × Ins. Acc.		1.26	
		(1.82)	
Donor Belief × Ins. Rej.			-6.79**
			(3.52)
Donor Belief × Ins. Acc.			-0.28
			(4.23)
Observations	567	567	486
Subjects	189	189	162

Note: The dependent variable is the observed chosen transfer level. The number of observed transfers is $N = 567$ – three for each of the 189 donors. Each regression includes individual donor fixed effects. "Own *Iddir*" is a dummy indicating that the donor and the recipient are from the same *Iddir*. "Donor belief" is derived from the categorical belief measure $b_i \in \{0, 1, 2, ..., 10\}$ – the distribution of which was illustrated in Figure 2 – by dividing the 10. The belief measure used here, interpreted as $E_i(z_j|m_j = 1)$, thus falls in the unit interval with 0 representing "highly unlikely" and 1 representing "highly likely". See notes to Table 2 for further details. Significance levels $p < 0.10^{*}$, $p < 0.05^{**}$, $p < 0.01^{***}$.

insurance.

Column 1 of Table 4 presents the results from estimating (2) pooling the 567 observed transfers made by the 189 donors. Robust standard errors are used reflecting the fact that the randomisation to donor or recipient occurred at the individual level Abadie et al. (2017).[13] The baseline transfers, when there is no insurance offer made to the recipient, $m_j = 0$, are thus on average 14.84 ETB. When the recipient is offered insurance but rejects it ($m_j = 1$ but $z_j = 0$) transfers are significantly reduced by 4.71 ETB (or 32%). When the recipient is offered insurance and accepts it ($m_j = 1$ and $z_j = 1$) transfers are significantly reduced by 9.68 ETB (or 65%).

Heterogeneity by beliefs about recipient behaviour and recipient identity

We now consider whether the reaction of the donor to the recipient either rejecting or accepting insurance varies with her beliefs about uptake behaviour. To do so we use an extended fixed

[13] The results are robust to clustering the standard errors at the session level or at the *Iddir* level.

effect specification,

$$\tau_i^k = \alpha + \beta_0 I_i^{k=0} + \beta_1 I_i^{k=1} + \lambda_0 I_i^{k=0} E_i + \lambda_1 I_i^{k=1} E_i + \mu_i + \epsilon_i^k, \quad k = b, 0, 1, \tag{3}$$

where E_i is shorthand for our measure of donor beliefs, $E_i[z_j|m_j = 1] \in [0, 1]$.[14]

This extension thus allows the response of the donor to the recipient being offered insurance and either rejecting or accepting the offer to depend on the donor beliefs. β_0 and β_1 thus capture the transfer responses when the donor's belief is zero, while γ_0 and γ_1 capture the additional effect of the treatment on transfers when the donor's belief increases from zero to unity.

The results from estimating (3) are provided in column 3 of Table 4. When the treatment conditions are interacted with the donor's beliefs the direct significant negative effect of the condition where the recipient rejects insurance ($m_j = 1$ but $z_j = 0$) disappears and is replaced by a significant negative interaction effect. This suggests that the reduction in transfer response by donors to the recipient rejecting insurance is driven by donors who firmly would expect insurance take-up by the recipient if offered: increasing the donor belief measure from zero to unity alters the transfer response from a non-response to a reduction of 6.8 ETB. What is interesting about these results is that when the recipient rejects insurance she has the same income prospect before transfers as when she is not offered insurance. The donor's choice to reduce transfers can thus only be driven by the decision of the recipient to reject insurance. It thus appears that donors who belief it is highly likely that the recipient takes-up insurance reduce transfers more than donors who belief it is highly unlikely that the recipient takes-up insurance. In contrast, in the condition where the recipient accepts insurance ($m_j = 1$ and $z_j = 1$) the interaction with donor beliefs is both numerically small and not statistically significant. Hence in this case, where the recipient already has a certain income, the donor's transfer reduction does not depend on her expectation about take-up.

A potential concern would be that the donor's belief about the likelihood that the recipient takes up insurance proxies for her own risk aversion. We have however already seen in Table 2 that donor beliefs have a weak relation to our measure of risk aversion. In Column 5 in Table B.4 in the Online Appendix we present the results of adding the interaction between treatment conditions and risk aversion to the regression with the interactions between treatment and donors' beliefs. We then find that the negative and significant interaction between transfers

[14] See Section III for details of how this measure was constructed.

when recipients reject insurance and donor beliefs is robust, even though the interaction between risk aversion and the treatment is positive and significant. Crucially this means that the differential response of low and high risk averse donors is unrelated to the recipient behaviour as the probability of the recipient receiving an insurance offer is entirely exogenous. Our result is also robust to the inclusion of all interactions of the treatment with any of the control variables.

We next consider whether a donor's transfer behaviour is different depending on whether the recipient is from the own *Iddir* or from another *Iddir*. To do so, we extend the estimating equation (2) using interaction terms as follows,

$$\tau_i^k = \alpha + \beta_0 I_i^{k=0} + \beta_1 I_i^{k=1} + \gamma_0 I_i^{k=0} I_i^{Own} + \gamma_1 I_i^{k=1} I_i^{Own} + \mu_i + \epsilon_i^k, \qquad k = b, 0, 1, \tag{4}$$

This extension thus allows the response of the donor to the recipient being offered insurance and either rejecting or accepting the offer to depend on whether the recipient is known (or not) to be from the own *Iddir*. β_0 and β_1 thus capture transfer responses when the donor knows that the recipient is not from the donor's *Iddir*, and γ_0 and γ_1 capture the the additional response when the donor knows that the recipient is from the own *Iddir*.

The results from estimating (4) are provided in column 2 of Table 4. The interaction terms are both economically small and not statistically significant. This indicates that the donor's transfer decision is not influenced by the identity of the recipient and suggests that local norms, that may exist between donors and recipients from the same local network do not influence redistribution in the experiment.

V A model

Setup

Consider an economy with a large population of individuals $i \in \{1, 2, ...\}$, heterogenous in type denoted $\theta_i \in \mathbb{R}$. Type has a distribution $\theta_i \sim N(\mu, 1)$ where μ is the mean/median of the distribution and where the variance has been normalized to unity.[15] θ_i is private information to individual i. For reasons that will become clear, it will be useful to define an individual's rank in the type distribution. Hence let $\Phi_i = \Phi(\theta_i; \mu)$ where $\Phi(\cdot; \mu)$ is the CDF for the normal distribution with mean μ (and unit variance).

[15] The assumption of normality is made for convenience only. The result would directly generalize to any symmetric unimodal distribution with support $[-\infty, \infty]$.

Similar to (the recipients in) the experiment, the individuals face a risk of an income loss $s_i \in \{0,1\}$. For simplicity, in the model we assume that, in the absence of an income loss, individual i has an income of unity but that this is completely lost in case of an income loss. Hence $y_i \in \{0,1\}$. The probability of a loss, denoted p, is the same for all individuals and income losses are independent across individuals. The utility of consumption is $u(c_i)$, where $u(\cdot)$ is defined on $\mathbb{R}_+$, is twice continuously differentiable, strictly increasing and strictly concave.

We next state some of the key model assumptions outlined above. First, each individual i interacts with one other member of the economy denoted j and is referred to as i's "partner" and pairings are random.

ASSUMPTION 1. ***Random pairing***. *Each individual i is randomly paired with another member of the economy, denoted j, but each individual's type is private information.*

Second, while μ is the true location of the type distribution, any individual i has a biased location belief, believing that others are more similar to her then they actually are.[16] We parameterize such belief-bias with a single parameter β.

ASSUMPTION 2. ***Egocentric false consensus bias***. *Let $\beta \in [0,1]$ and assume that individual i believes that the location of the type distribution is $\mu_i \equiv (1-\beta)\mu + \beta\theta_i$ and also expects this to be the belief of all other individuals in the economy.*

There is a social expectation that an individual who does not suffer an income loss should share some of her income with a partner who does. We model such social pressure as an expected transfer $\widetilde{\tau}$. Due to the norm being internalized, an individual who deviates from the expected transfer, will experience a disutility in the form of guilt or shame. However, this negative feeling is assumed to be decreasing in the perceived social distance to the partner. Hence we define $\delta_i \equiv |\theta_j - \theta_i|$ as the (Euclidean) type-distance between i and her partner j. As type is private information, individual i holds an expectation over this distance which will be described in more detail shortly below. The guilt felt by the donor is modelled as $\Delta\tau_i \eta(\delta_i)$ where

$$\Delta\tau_i \equiv |\widetilde{\tau} - \tau_i| \qquad \text{and} \qquad \eta(\delta_i) \equiv \eta_0 - \eta_1 \delta_i, \tag{5}$$

with $\eta_0 \geq 0$ and $\eta_1 \geq 0$. The linear specification is assumed for convenience so as exploit linearity

[16] Hence we assume that everyone has the same belief about the spread of the distribution. An underestimation of the spread would make a relatively central type underestimate her distance to other types, but will make a non-central type overestimate her distance.

of the expectations operator. For analytical convenience we will assume that the strength of social pressure is weak enough that all individuals will deviate from the socially expected transfer, thereby allowing us to characterize a distribution of interior transfers.[17]

Assumption 3. ***Social expectations and internalized sharing norm.*** *(i) There is a socially conditioned reference transfer level $\widetilde{\tau} > 0$. (ii) An individual who deviates from $\widetilde{\tau}$ experiences a utility loss ("guilt") that is proportional to the size of the deviation but decreasing in the (expected) social distance to the partner, $\Delta\tau_i\eta(\delta_i)$ and (iii) the socially expected transfer is large relative to baseline feelings of guilt, $u'(1-\widetilde{\tau}) > \eta_0$.*

Before proceeding it is worthwhile to consider the nature of the assumed belief-bias in some more detail. In particular any individual – except for someone who is exactly of median type – will be mistaken about her rank Φ_i in the distribution of types, and as a consequence she will also misperceive the expected distance between herself and her partner. We break this down in two steps.

First we define the true expected distance between i and j given i's rank. In particular, let θ_i and θ_j be i.i.d. draws from the true type distribution, $N(\mu, 1)$, and define

$$\Delta(\Phi_i) \equiv E[\delta_i|\Phi_i] = E[|\theta_j - \theta_i|\,|\Phi(\theta_i;\mu) = \Phi_i]. \tag{6}$$

Note that, per construction, $\Delta(\Phi_i)$ does not depend on μ.

Second, we define the own perceived rank of an individual of true rank Φ_i when the belief-bias is β. This is defined as,

$$\widetilde{\Phi}(\Phi_i;\beta) \equiv \Phi(\theta_i,(1-\beta)\mu + \beta\theta_i) \text{ with } \theta_i = \Phi^{-1}(\Phi_i,\mu). \tag{7}$$

This function strictly depends on β (but is still independent of μ). The left panel of Figure 5 illustrates the individual's perceived rank as function of her true rank $\widetilde{\Phi}(\Phi_i;\beta)$ for the case of $\beta = 0.5$. The fact that the perceived rank is above (below) the red hatched 45 degree line at any true rank $\Phi_i < 0.5$ ($\Phi_i > 0.5$) highlights how, under biased beliefs, all types – except the true median – misperceive their rank, believing they are more central than they are.

The right panel illustrates $\Delta\left(\widetilde{\Phi}(\Phi_i;\beta)\right)$ – the expected distance to the partner perceived

[17]While corner solutions with zero transfers are conceivable, we will for simplicity ignore these in the theoretical exposition, but will allow for them in the numerical example.

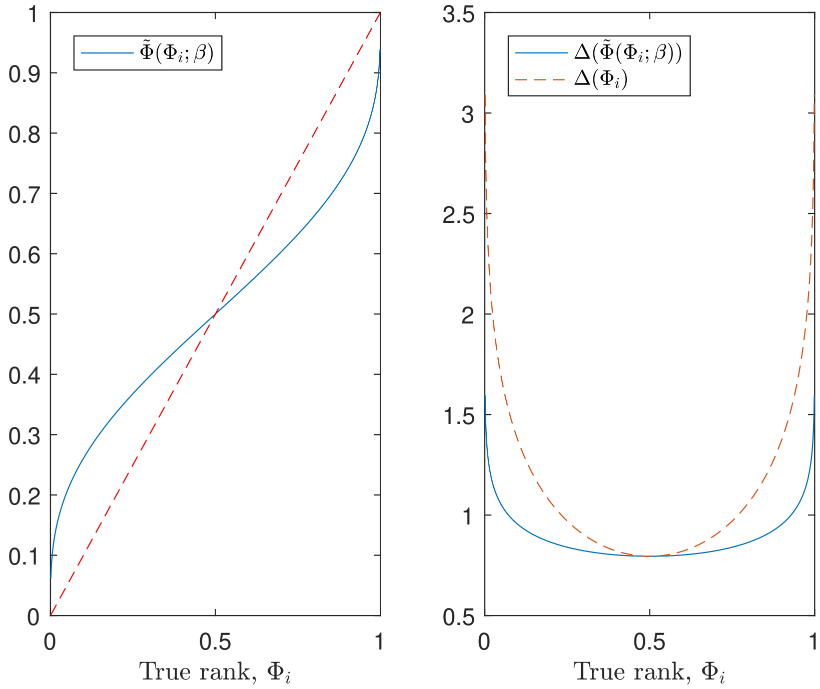

Figure 5: Perceived rank and perceived expected distance.

by the individual as a function of her true rank and given belief-bias $\beta = 0.5$. Due to bias any individual – except for the true median type – perceives an expected distance to the partner is lower than her true expected distance (shown by the red hatched line).

The following lemma formally notes that the expected distance to the partner perceived by any individual as a function of her true rank is indeed U-shaped and decreasing in the degree of bias.

LEMMA 1. *The individual's perceived expected distance* $\Delta\left(\widetilde{\Phi}\left(\Phi_i;\beta\right)\right)$ *is U-shaped with respect to her true rank* Φ_i *with a minimum at* $\Phi_i = 1/2$ *and is decreasing in* β *for all* $\Phi_i \in (0,1)$, *except for the true median* $\Phi_i = 1/2$.

Proof. See Appendix A.

THE NO-INSURANCE REGIME

We consider first the no-insurance environment. While types are private information the income realizations are mutually observable by partners. If i does not suffer an income loss but her partner j does, i makes a transfer to j. i's transfer is assumed to depend on her type, as different types perceive different distances to their randomly allocated partners.

In order to characterize the transfers made in this environment we can ignore bias for just a moment. Consider the transfer problem,

$$\max_{\tau_i} \left\{ u\left(1-\tau_i\right) - \Delta\tau_i\eta\left(E\left[\delta_i|\Phi_i\right]\right)\right\}, \tag{8}$$

where we used that, due to (5), $E\left[\eta\left(\delta_i\right)|\Phi_i\right] = \eta\left(E\left[\delta_i|\Phi_i\right]\right)$. Trivially, no agent will ever choose a transfer above $\widetilde{\tau}$, hence only downward deviations will be relevant. Indeed, noting that $E\left[\delta_i|\Phi_i\right] > 0$ for any $\Phi_i \in [0,1]$, Assumption 3 implies that the chosen transfer will always fall short of the socially expected one.

The solution to this problem, denoted $\tau^b\left(\Phi_i\right)$, is characterized by the associated first order condition,

$$u'\left(1-\tau^b\left(\Phi_i\right)\right) = \eta\left(E\left[\delta_i|\Phi_i\right]\right). \tag{9}$$

$\tau^b\left(\Phi_i\right)$ is the transfer that <u>would have been chosen</u> by an individual of rank Φ_i in the absence of belief-bias. But of course, due to biased beliefs, the transfer chosen by an individual of true rank Φ_i reflects her perceived rank $\widetilde{\Phi}\left(\Phi_i;\beta\right)$ via her perceived expected distance $\Delta\left(\widetilde{\Phi}\left(\Phi_i;\beta\right)\right)$ rather than her true rank/expected distance. Hence the transfer chosen by an individual of true rank Φ_i and given the bias β in the no-insurance regime is (slightly abusing the notation) given by

$$\tau^b\left(\Phi_i;\beta\right) \equiv \tau^b\left(\widetilde{\Phi}\left(\Phi_i;\beta\right)\right). \tag{10}$$

The properties of the perceived expected distance (Lemma 1) thereby carry over to the transfer in the no-insurance regime: individuals who are further away from the true median, transfer less and stronger belief-bias implies that everyone (except a true median individual) transfers more. An example will be illustrated below.

The insurance regime

Insurance, when available, is assumed to be actuarially fair and complete. Hence the premium associated with insurance is p and an individual who takes up insurance has her uncertain income replaced with the certain income $1-p$. Let $z_i \in \{0,1\}$ indicate take-up by individual i. Taking up insurance is associated with a type-specific take-up cost.

Assumption 4. ***Takeup cost.*** *Taking up insurance has a type-specific utility cost $\chi\left(\theta\right)$, where $\chi\left(\cdot\right)$ is defined on $\mathbb{R}$ and is continuous, strictly increasing and strictly convex in θ, additionally* *satisfying* $\lim_{\theta \to -\infty} \chi(\theta) = 0$ *and* $\lim_{\theta \to +\infty} \chi(\theta) = \infty$.

We assume that partners observe each others' take-up decisions.

Assumption 5. ***Observability of take-up decisions****. The take-up decisions* (z_i, z_j) *of any set of partners* (i, j) *are mutually observable within the pair.*

Remark 1. *Note that while individual* i *observes* z_j *and vice versa, neither observes the take-up decisions by non-partners in the economy. If individual* i *could observe the aggregate take-up rate, her beliefs would be revealed to be wrong before making a potential transfer to* j.

In this regime, transfers are made to uninsured individuals who suffer income losses. Transfers may come either from individuals who took up insurance or from individuals who did not take up insurance but then did not suffer an income loss. In order to characterize the equilibrium take-up decision of an individual of true type θ_i we need to characterize her beliefs about the take-up and transfer behaviour of others. Note that, since the individuals in the economy have biased beliefs about the location of the distribution of types, they will generally also have biased beliefs about the equilibrium behaviour of others. An individual of type θ_i, who believes that the location of the type distribution is at μ_i (Assumption 2) – and expects that others share her belief – will thus anticipate an equilibrium consistent with this particular location of the type distribution.

Anticipated equilibria

We thus proceed by characterizing the equilibrium that would obtain if a particular location μ_i was true and known to all, as this represents i's beliefs about the behaviour of others. Such an anticipated equilibrium consists of an insurance take-up rate and description of the transfer that each individual in the particular type distribution would make. Given the arbitrary location of the distribution, it is more convenient to characterize the behaviour of individuals in terms of their rank.

As in the case of the no-insurance regime, the transfer made by an individual i to a partner who has suffered an income loss will depend on her expected distance to the partner. However, whereas in the no-insurance regime the donor had no information about the identity of the partner, in the insurance regime the donor will have the information that the recipient chose not to take up insurance. All anticipated equilibria will have the standard property that there is a threshold type separting those who took insurance and those who rejected it. Hence if there is a take-up rate of $\widehat{\Phi}$ and i observes that her partner rejected insurance, she will infer that $\Phi_j > \widehat{\Phi}$.

We thus generalize the definition in (6) to the expected distance between a donor of type rank Φ_i and an uninsured partner when the insurance take-up rate is $\widehat{\Phi}$. Hence as before, let θ_i and θ_j be i.i.d. draws from $N(\mu', 1)$ where μ' is an arbitrary mean, and now define

$$\Delta\left(\Phi_i, \widehat{\Phi}\right) \equiv E\left[\delta_i | \Phi_i, \Phi_j \geq \widehat{\Phi}\right] = E\left[|\theta_j - \theta_i| \,|\Phi\left(\theta_i; \mu'\right) = \Phi_i, \Phi\left(\theta_j; \mu'\right) \geq \widehat{\Phi}\right]. \tag{11}$$

Note that $\Delta\left(\Phi_i, \widehat{\Phi}\right)$ does not depend on the arbitrary location μ'.

Figure 6 illustrates the expected distance function $\Delta\left(\Phi_i, \widehat{\Phi}\right)$. The special case $\Delta(\Phi_i, 0)$ reduces to the distance function defined in (6) as the no-insurance case corresponds to the zero take-up case. Another special case is when both the donor's rank and the take-up rate goes to unity; in that case the expected distance approaches zero.

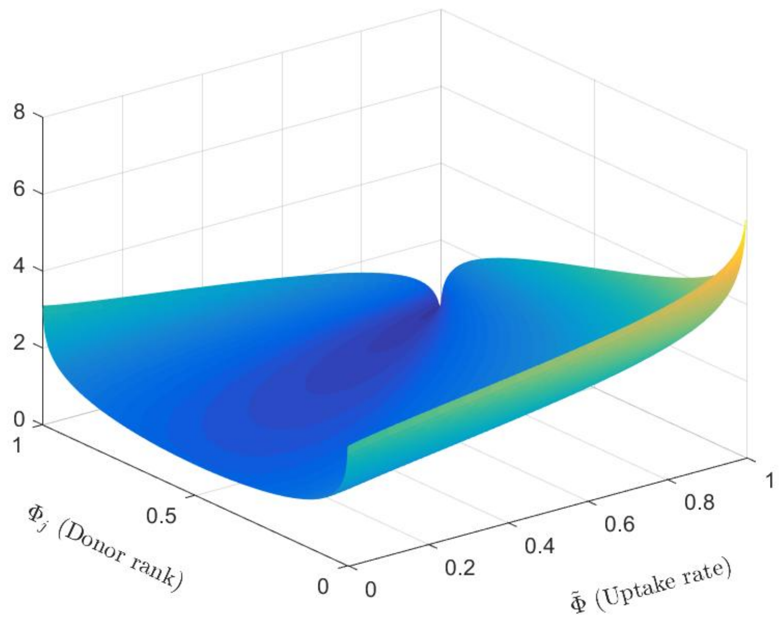

Figure 6: Expected distance by donor rank and uptake rate.

We assume that the reference transfer level $\widetilde{\tau}$ continues to apply in the case where the partner remains uninsured. Consider then the transfer from i to j when the take-up rate is $\widehat{\Phi}$, characterized through the first order condition,

$$u'\left(1 - pI_{\{\Phi_i \leq \widehat{\Phi}\}} - \tau\left(\Phi_i, \widehat{\Phi}\right)\right) = \eta\left(E\left[\delta_i | \Phi_i, \Phi_j \geq \widehat{\Phi}\right]\right), \tag{12}$$

where $I_{\{.\}}$ is the indicator function that is unity if the statement in brackets is true and zero otherwise. It is used here because the income of the donor is reduced from 1 to $1 - p$ if she herself takes up insurance. The analytical convenience of $\tau\left(\Phi_i, \widehat{\Phi}\right)$ is that it does not depend on the location of the type-distribution. As such it characterizes the expectation of <u>any</u> individual in the economy of the transfer that would be made by <u>any</u> donor of rank Φ_i <u>if</u> the aggregate take-up rate was $\widehat{\Phi}$.

Using the fact that transfers depend on expected distance, we can further define $V^1\left(\Phi_i, \widehat{\Phi}\right)$ as the expected utility – inclusive of any feelings of guilt – of an individual of rank Φ_i from accepting insurance when the aggregate take-up rate is $\widehat{\Phi}$. Similarly, we can define $V^0\left(\Phi_i, \widehat{\Phi}\right)$ as the expected utility – again inclusive of any feelings of guilt – to an individual of rank Φ_i from rejecting insurance when the aggregate take-up rate is $\widehat{\Phi}$. As the expressions for these values are lengthy they have been relegated to Appendix A.

The expected net gain from acquiring insurance is defined as

$$V\left(\Phi_i, \widehat{\Phi}\right) \equiv V^1\left(\Phi_i, \widehat{\Phi}\right) - V^0\left(\Phi_i, \widehat{\Phi}\right). \tag{13}$$

In the equilibrium anticipated by agent i with location-belief μ_i there is an aggregate take-up rate $\widehat{\Phi}(\mu_i)$ with the property that an individual of rank $\widehat{\Phi}(\mu_i)$ has an expected net gain from acquiring insurance that exactly matches her take-up cost when the take-up rate is $\widehat{\Phi}(\mu_i)$. Hence it is the solution to the implicit equation,

$$V\left(\widehat{\Phi}, \widehat{\Phi}\right) - \chi\left(\Phi^{-1}\left(\widehat{\Phi}; \mu_i\right)\right) = 0. \tag{14}$$

Definition 1. *An <u>anticipated equilibrium</u> given location-belief μ_i consists of (i) an insurance take up rate $\widehat{\Phi}(\mu_i) \in [0, 1]$ that is the solution to (14) and (ii) a transfer function $\widehat{\tau}(\Phi, \mu_i) \equiv \tau\left(\Phi, \widehat{\Phi}(\mu_i)\right)$, where $\tau\left(\Phi, \widehat{\Phi}\right)$ is characterized by (12), describing the transfer made by an individual (either insured or uninsured without an income loss) of type rank $\Phi \in [0, 1]$ to an uninsured partner with an income loss when the takeup rate is $\widehat{\Phi} \in [0, 1]$.*

For simplicity we assume that $V(0,0) > 0$.[18] The existence of an interior equilibrium $\widehat{\Phi}(\mu_i) \in (0,1)$ is then guaranteed by the fact that take-up costs are very large for sufficiently high types (Assumption 4). While multiple equilibria are conceivable, this is not the focus here. Hence we assume the existence of a unique solution, which is then also locally stable.[19] As an upward shift in the location μ_i increases the θ-value at every rank, it follows that an increase in μ_i is associated with a strict decrease in the anticipated take-up rate. As the perceived location μ_i is increasing in the true type θ_i, the result immediately carries over to a monotonicity of the anticipated equilibrium with respect to individual type.

Lemma 2. *The anticipated insurance take-up rate, $\widehat{\Phi}(\mu_i)$ with $\mu_i \equiv (1-\beta)\mu + \beta\theta_i$, is, for any positive belief bias $\beta \in (0,1]$, decreasing in the individual's type θ_i. In the absence of any belief bias, $\beta = 0$, all individuals anticipate the same insurance take-up rate.*

Proof. See Appendix A.

The full equilibrium in the insurance regime

The anticipated equilibria vary across the individuals as they hold different beliefs about the location of the type-distribution and, as a consequence, also about the equilibrium behaviour of others. Full equilibrium in the insurance environment obtains when each individual's behaviour is privately optimal given the behaviour that she anticipates of others.

Definition 2. ***Full equilibrium in the insurance regime.*** *In the full equilibrium in the environment where insurance is available all individuals make insurance take-up and transfer decisions that are in accordance with their anticipated equilibria given their type-specific beliefs about the location of the type distribution.*

Consider first the insurance take-up decision of an individuals of true rank Φ_i. She beliefs that the location of the type distribution is $\mu_i = (1-\beta)\mu + \beta\Phi^{-1}(\Phi_i, \mu)$ and anticipates the take-up rate to be $\widehat{\Phi}(\mu_i)$. Moreover, she will take up insurance herself if and only if the rank that she perceives herself to be of, that is $\widetilde{\Phi}(\Phi_i; \beta)$, is no larger than $\widehat{\Phi}(\mu_i)$. Hence we can

[18] This will always hold as long as guilt is sufficiently limited: in that case the lowest type will not expect a sizeable transfer from a random partner if she remains uninsured and will hence opt to take up insurance even if no one else does so.

[19] Local stability means that $V\left(\widehat{\Phi}, \widehat{\Phi}\right) - \chi\left(\Phi^{-1}\left(\widehat{\Phi}; \mu_i\right)\right) = 0$ is strictly decreasing in $\widehat{\Phi}$ at $\widehat{\Phi}(\mu_i)$.

characterize the equilibrium insurance take-up as a function of true rank as follows,

$$z^* (\Phi_i; \beta) = \begin{cases} 1 & \text{if } \widetilde{\Phi} (\Phi_i; \beta) \leq \widehat{\Phi} \left((1-\beta) \mu + \beta \Phi^{-1} (\Phi_i, \mu) \right) \\ 0 & \text{if } \widetilde{\Phi} (\Phi_i; \beta) > \widehat{\Phi} \left((1-\beta) \mu + \beta \Phi^{-1} (\Phi_i, \mu) \right) \end{cases} . \tag{15}$$

Using that the individual's perceived rank is increasing in her true rank while her anticipated take-up rate is decreasing (Lemma 2) it follows that the full equilibrium also has a threshold property.

Proposition 1. *In the full equilibrium, given belief-bias $\beta \in [0,1]$, there will be a threshold type $\theta^* (\beta)$ such that $z^* (\Phi_i; \beta) = 1$ if $\Phi_i \leq \Phi (\theta^* (\beta); \mu)$ and $z^* (\Phi_i; \beta) = 0$ otherwise.*

Proof. See Appendix A.

We can further characterize the transfer made by each individual in the full equilibrium as a function of her true rank Φ_i. Recall that $\tau \left(\Phi, \widehat{\Phi} \right)$, defined in (12), is the transfer that any individual i anticipates to be made by a donor of rank Φ to an uninsured recipient when the take-up rate is $\widehat{\Phi}$. Hence i's equilibrium transfer can be characterized as that expected of someone of her own perceived rank at her anticipated equilibrium takeup rate. That is,

$$\tau^* (\Phi_i; \beta) = \tau \left(\widetilde{\Phi} (\Phi_i; \beta), \widehat{\Phi} (\mu_i) \right) \text{ with } \mu_i = (1-\beta) \mu + \beta \Phi^{-1} (\Phi_i, \mu) . \tag{16}$$

Comparison of (16) to (10) shows how the equilibrium transfers are a generalization of the transfers that would be made in the absence of insurance and hence zero take-up.

There is no general result on the relative size of the equilibrium transfer in the insurance regime $\tau^* (\Phi_i; \beta)$ and the baseline transfer $\tau^b (\Phi_i; \beta)$. This will generally vary with the individual's type. However, the model naturally predicts that low types will transfer less to partners who chose not to take up insurance than they would to the same partner had insurance not been available. This happens for two reasons. First, they transfer less due to a negative income effect as they have themselves obtained insurance and hence paid the premium p. But second, and more importantly, they transfer less as they have now received the information that the partner is of a relatively high type – of a rank above the donor's anticipated take-up rate – and hence reducing the feelings of guilt associated with deviating from the socially determined reference transfer.

To illustrate, consider the case of CARA utility, $u (c_i) = [1 - \exp (-\gamma c_i)] / \gamma$ and an exponential take-up cost function $\chi (\theta) = \nu \exp (\theta)$ where $\nu > 0$.

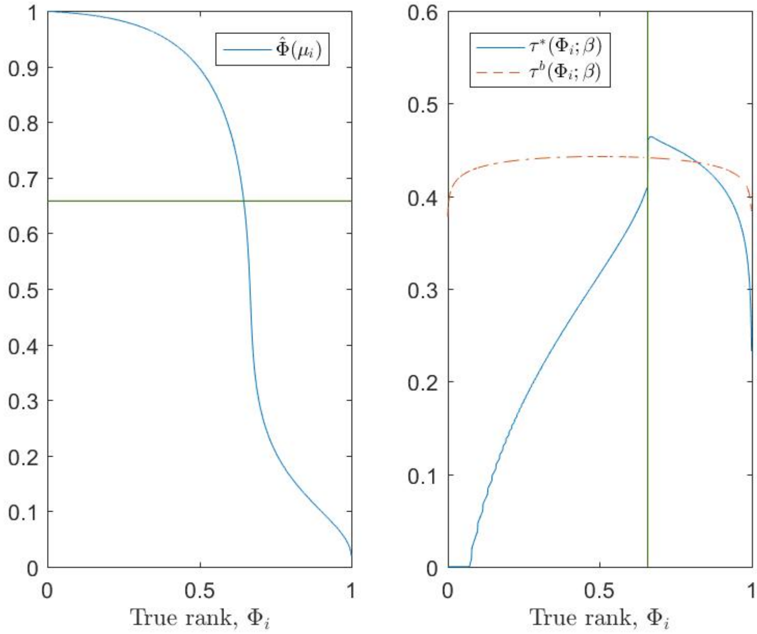

Figure 7: Anticipated take-up rates and equilibrium transfers

The left panel of Figure 7 shows the anticipated take-up rate $\widehat{\Phi}(\mu_i)$ as a function of the individual's true rank when the bias parameter is $\beta = 0.5$, the true location is $\mu = -0.8$, the degree of risk aversion $\gamma = 2$, the loss risk is $p = 0.05$, and the take-up cost parameter is $\nu = 0.002$, the reference transfer is $\widetilde{\tau} = 0.5$ ("full sharing"), and the internalized norm parameters are $\eta_0 = e^{-\gamma/2}$ and $\eta_1 = 0.05$.[20]

The right panel illustrates the equilibrium transfers – with and without insurance available – by the donor's true rank (with the horizontal line now indicating the insurance take-up rate in the full equilibrium). The discontinuity in $\tau^*(\Phi_i;\beta)$ reflects the income effect obtaining from the fact that all individuals of true rank below the equilibrium take-up rate have obtained insurance and hence only have net income $1-p$. But the main difference is the sharp reduction of transfers made by low types as they now feel less guilt associated with making smaller transfers to their now revealed high type uninsured partners. Hence, in general, in an equilibrium with a high insurance uptake rate, the model naturally predicts that a majority of individuals will reduce their transfers to partners who rejects insurance, and the size of the transfer-reduction is larger

[20]Note that the chosen transfer takes the general form $\tau = 1+\frac{1}{\gamma}\log(\eta_0 - \eta_1\delta)$ where δ is the (expected) distance to the partner. The particular choice of η_0 implies that the transfer chosen when the expected distance is zero is 0.5, thus coinciding with the assumed reference transfer.

for lower types who anticipate higher uptake rates.

Welfare

While the model is consistent with the stylized facts from the experiment a further attractive feature is that it has well-defined and stable preferences, making it particularly suitable for welfare analysis. While a full welfare analysis goes beyond the scope of the current paper, we will here briefly discuss the likely effects of the introduction of an insurance market with a "high" equilibrium uptake rate.

The expected consumption of individuals who take up insurance can be expected to decrease – to below their expected income – as they bear the premium-cost of insuring their own income, but continue to make some positive expected transfers. However, the main effect on the insurance-takers is of course the positive effect of consumption smoothing through insurance. For the non-takers of insurance, the effects of the introduction of an insurance market is very much the opposite. Their expected income may well increase – to above their expected income – as they will rarely be making any transfers (as their partners are most commonly insured) but they still receive some transfers. However, as their mostly-insured partners reduce their transfers relative to the no-insurance setting, the increase in expected consumption may be modest and, most critically, their consumption will be less smoothed through transfers in the loss state.

As a result, while the majority of the individuals take up insurance and generally gain in terms of expected own utility of consumption, there will be a tail of the population who will fail to take up insurance and who will now face higher consumption volatility due to the general reduction of private redistributive transfers. While the impact on the welfare of this group – in terms of expected own utility of consumption – is generally ambiguous, if the reduction in private transfers is substantial, this group will be closer to autarky after the introduction of insurance and can then be expected to be worse off.[21]

VI Conclusion

Transfers motivated by altruism, norms of giving, or guilt play an important role in supporting individuals who suffer income losses due to risk, especially in the absence of well-functioning

[21] Indeed, all of the above effects occur in the example above. For all types taking up insurance, expected consumption decreases, consumption variance decreases, and the expected own consumption utility increases. For all the non-takers, expected consumption increases, consumption variance increases, and the expected own consumption utility decreases.

insurance markets. In this paper we present empirical evidence from an artefactual field experiment showing that the introduction of formal insurance can reduce such private redistributive transfers, including to recipients who do take up the offer of insurance. We have further shown that the empirical findings are consistent with a simple theory where the introduction of an insurance market with observable take-up decisions reveals social distances, making donors feel less guilty about not adhering to a social norm of giving. The upshot of our findings is that the benefits of the introduction of formal insurance can be very unevenly distributed, potentially making already vulnerable individuals worse off. Since emerging markets are becoming the main source of premium growth to the global insurance industry this is especially relevant to those who, due to structural heterogeneity, may face constraints to insurance adoption in these markets.

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Appendix A: Proofs

Proof of Lemma 1. We note first that $\Delta(\Phi_i)$ defined in (6) is trivially U-shaped with a minimum at $\Phi_i = 1/2$ as types further away from the mean/median have a larger expected distance to a randomly allocated partner.

Next we demostrate a set of properties of the individual's perceived rank as a function of her true rank, $\widetilde{\Phi}(\Phi_i; \beta)$, defined in (7), starting with monotonicity in Φ_i. To see this property, differentiate (7) with respect to Φ_i to obtain

$$\frac{\partial \widetilde{\Phi}(\Phi_i; \beta)}{\partial \Phi_i} = \left[\frac{\partial \Phi(\theta_i; \mu_i)}{\partial \theta_i} + \beta \frac{\partial \Phi(\theta_i; \mu_i)}{\partial \mu_i} \right] \frac{\partial \Phi^{-1}(\Phi_i; \mu)}{\partial \Phi_i}, \tag{A.1}$$

with $\theta_i = \Phi^{-1}(\Phi_i; \mu)$ and $\mu_i = (1-\beta)\mu + \beta \Phi^{-1}(\Phi_i; \mu)$. But, naturally,

$$\frac{\partial \Phi(\theta_i; \mu_i)}{\partial \theta_i} = -\frac{\partial \Phi(\theta_i; \mu_i)}{\partial \mu_i} = \phi(\theta_i; \mu_i), \tag{A.2}$$

where $\phi(\theta_i; \mu_i)$ is the normal probability density function given the mean μ_i (and unit standard deviation) evaluated at θ_i. Hence, substituting, yields that

$$\frac{\partial \widetilde{\Phi}(\Phi_i; \beta)}{\partial \Phi_i} = (1-\beta)\, \phi\left(\Phi^{-1}(\Phi_i; \mu), (1-\beta)\mu + \beta \Phi^{-1}(\Phi_i; \mu)\right) \frac{\partial \Phi^{-1}(\Phi_i; \mu)}{\partial \Phi_i}. \tag{A.3}$$

This shows that, for any $\beta \in (0,1)$, $\partial \widetilde{\Phi}(\Phi_i; \beta) / \partial \Phi_i > 0$ at any rank Φ_i. In the limit where $\beta = 1$, $\partial \widetilde{\Phi}(\Phi_i; \beta) / \partial \Phi_i = 0$ as everyone perceives herself to be median. In the limit where $\beta = 0$, the individual's perceived mean μ_i coincides with the true mean and it follows that $\partial\widetilde{\Phi}(\Phi_i;\beta)/\partial\Phi_i = 1$ at any Φ_i as expected. We also note that the true median never misperceives her rank. This follows as evaluating (7) at $\Phi_i = 1/2$, immediately yields $\widetilde{\Phi}(1/2;\beta) = \Phi(\mu;\mu) = 1/2$ for any β where we used that $\Phi^{-1}(1/2;\mu) = \mu$. These first two properties of the perceived rank implies that the U-shape of $\Delta(\Phi_i)$ carries over to $\Delta\left(\widetilde{\Phi}(\Phi_i;\beta)\right)$ for any $\beta \in (0,1)$.

Further, differentiating (7) with respect to β yields that

$$\frac{\partial\widetilde{\Phi}(\Phi_i;\beta)}{\partial\beta} = -\phi(\theta_i;\mu_i)\left(\Phi^{-1}(\Phi_i;\mu) - \mu\right), \tag{A.4}$$

where we used (A.2) again. Since $\Phi^{-1}(\Phi_i;\mu)$ is smaller (larger) than μ when $\Phi_i < 1/2$ ($> 1/2$) it follows that $\partial\widetilde{\Phi}(\Phi_i;\beta)/\partial\beta > 0$ at any $\Phi_i < 1/2$ and $\partial\widetilde{\Phi}(\Phi_i;\beta)/\partial\beta < 0$ at any $\Phi_i > 1/2$. Hence the larger is β the more central any type perceives herself to be and, as a consequence, she also perceives a smaller expected distance to her random partner. #

The Expected Value Functions

In order to characterize the expected values associated with taking up and rejecting insurance, we will need to slightly generalize the definition in (12) to allow for a specific income. Hence define $\tau\left(\Phi_i,\widehat{\Phi};y_i\right)$ implicitly through

$$u'\left(y_i - \tau\left(\Phi_i,\widehat{\Phi};y_i\right)\right) = \eta\left(E\left[\delta_i|\Phi_i,\Phi_j \geq \widehat{\Phi}\right]\right). \tag{A.5}$$

This transfer can be interpreted as the transfer made by an donor of rank Φ_i and income y_i to an uninsured partner j when the expected take-up rate is $\widehat{\Phi}$.

We can now characterize the expected utility to an individual of rank Φ_i of accepting insurance – net of the own take up cost – when the expected take up rate is $\widehat{\Phi}$. Note that this expected utility, denoted $V^1\left(\Phi_i,\widehat{\Phi},\mu_i\right)$, includes expected feelings of guilt,

$$\begin{aligned} V^1\left(\Phi_i,\widehat{\Phi}\right) \equiv\ & u(1-p)\left[\widehat{\Phi} + \left(1-\widehat{\Phi}\right)(1-p)\right] \\ & + u\left(1-p-\tau\left(\Phi_i,\widehat{\Phi},1-p\right)\right)\left(1-\widehat{\Phi}\right)p \\ & - \eta\left(E\left[\delta_i|\Phi_i,\Phi_j > \widehat{\Phi}\right]\right)\left(\left|\widehat{\tau} - \tau\left(\Phi_i,\widehat{\Phi},1-p\right)\right|\right)\left(1-\widehat{\Phi}\right)p. \end{aligned} \tag{A.6}$$

The first two terms capture the expected own utility from consumption while the final terms captures the expected feeling of guilt arising from the deviation from the social expectation in the case where the partner has opted to remain uninsured.

In a corresponding way, we can characterize the expected utility to an individual of rank Φ_i of rejecting insurance when the expected take-up rate is $\widehat{\Phi}$, denoted $V^0\left(\Phi_i, \widehat{\Phi}, \mu_i\right)$. The expression in this case is slightly more involved for two reasons. First, there is a larger set of possible outcomes to consider. Second, as i may in this case receive a transfer from j whose identity is not known to i, making the size of the transfer uncertain to i. Taking all possible outcomes into account, gives that

$$\begin{aligned} V^0\left(\Phi_i, \widehat{\Phi}\right) \equiv\ & (1-p)\left[\widehat{\Phi} + \left(1-\widehat{\Phi}\right)(1-p)\right] u(1) \\ & + \left(1-\widehat{\Phi}\right) p^2 u(0) \\ & + p\left\{\widehat{\Phi} E\left[u\left(\tau\left(\Phi_j, \widehat{\Phi}, 1-p\right)\right) | \Phi_j \leq \widehat{\Phi}\right] + \left(1-\widehat{\Phi}\right)(1-p) E\left[u\left(\tau\left(\Phi_j, \widehat{\Phi}, 1\right)\right) | \Phi_j > \widehat{\Phi}\right]\right\} \\ & + \left(1-\widehat{\Phi}\right) p(1-p) u\left(1-\tau\left(\Phi_i, \widehat{\Phi}, 1\right)\right) \\ & - \left(1-\widehat{\Phi}\right) p(1-p) \eta\left(E\left[\delta_i | \Phi_i, \Phi_j > \widehat{\Phi}\right]\right)\left(\left|\widehat{\tau} - \tau\left(\Phi_i, \widehat{\Phi}, 1\right)\right|\right). \end{aligned} \tag{A.7}$$

The first three terms captures the expected own utility from consumption while the final terms captures expected feelings of guilt. #

Proof of 2. Immediate from comparative statics on (14) and using local stability. #

Proof of Proposition 1. The proof of Lemma 1 shows that $\widetilde{\Phi}(\Phi_i; \beta)$ is strictly increasing in Φ_i for any $\beta \in [0, 1)$, and we also know that $\widetilde{\Phi}(\Phi_i; \beta) = 1/2$ for all Φ_i at $\beta = 1$ as, with complete bias, all individuals believe that they are median in the distribution. Hence $\widetilde{\Phi}(\Phi_i; \beta)$ is strictly decreasing in Φ_i for all $\beta \in [0, 1)$ and independent of Φ_i if $\beta = 1$. Lemma 2 shows that $\widehat{\Phi}(\mu_i)$ is strictly decreasing in μ_i, and hence also in Φ_i, for any $\beta \in (0, 1]$ and independent of Φ_i if $\beta = 0$. Hence it follows that $\widetilde{\Phi}(\Phi_i; \beta) - \widehat{\Phi}\left((1-\beta)\mu + \beta\Phi^{-1}(\Phi_i; \mu)\right)$ is strictly decreasing in Φ_i for any $\beta \in [0, 1]$. #

Appendix B: Online Appendix

Proof Alternative Altruism Framework

Here we show how the current model based on an internalized norm of income sharing with a socially conditioned expected transfer is observationally equivalent to a model with altruistically motivated transfers. The setup of the alternative altruism model is identical to that presented in Section V, with the exception that there is no longer any reference transfer. Instead, individual i has caring preferences toward her partner j that decline in social distance. Hence Assumption 3 is replaced with the following

Assumption 6. *Individual i has caring preferences towards her partner j of strength α_i that decreases in the type-distance to the partner, $\alpha_i = a_0 - a_1\delta_i$ where $a_0 \in [0,1]$ and $a_1 \geq 0$.*

In the no-insurance regime, a transfer is still made by i to j when j suffers an income loss while i does not. As i does not know the identity of the partner, her degree of caring is in expected form, $E[\alpha_i|\Phi_i] = a_0 - a_1\Delta(\Phi_i)$ where $\Delta(\Phi_i)$ is as given in (6). This transfer solves $\max_{\tau_i}\{u(1-\tau_i) - E[\alpha_i|\Phi_i]\,u(\tau_i)\}$ and defines the (unbiased) baseline transfer $\tau^b(\Phi_i)$ in the current context,

$$\frac{u'\left(\tau^b(\Phi_i)\right)}{u'\left(1-\tau^b(\Phi_i)\right)} = \frac{1}{E[\alpha_i|\Phi_i]}. \tag{B.1}$$

As in the current model, the equilibrium transfer under biased beliefs about the type distribution is $\tau^b(\Phi_i;\beta) = \tau^b\left(\widetilde{\Phi}(\Phi_i;\beta)\right)$.

In the insurance regime, Assumptions 4 and 5 about takeup costs and observability are unchanged. The transfer from i to j at the takeup rate $\widehat{\Phi}$ is now characterized by

$$\frac{u'\left(\tau\left(\Phi_i,\widehat{\Phi}\right)\right)}{u'\left(1-pI_{\{\Phi_i\leq\widehat{\Phi}\}} - \tau\left(\Phi_i,\widehat{\Phi}\right)\right)} = \frac{1}{E\left[\alpha_i|\Phi_i,\Phi_j\geq\widehat{\Phi}\right]}. \tag{B.2}$$

The main difference between the two models is with respect to the value functions associated with taking up and rejecting insurance as caring preferences implies that individual i cares not only about the partner's benefit from receiving the transfer but also about the partner's expected insurance takeup cost. These values now take the form

$$\begin{aligned} V^1\left(\Phi_i,\widehat{\Phi},\mu_i\right) &\equiv u(1-p)\left[\widehat{\Phi}+\left(1-\widehat{\Phi}\right)(1-p)\right]+u\left(1-p-\tau\left(\Phi_i,\widehat{\Phi},1-p\right)\right)\left(1-\widehat{\Phi}\right)p \\ &+\widehat{\Phi}u(1-p)E\left[\alpha_i|\Phi_i,\Phi_j\leq\widehat{\Phi}\right] \qquad \text{(B.3)} \\ &+\left(1-\widehat{\Phi}\right)\left\{(1-p)u(1)+pu\left(\tau\left(\Phi_i,\widehat{\Phi},1-p\right)\right)\right\}E\left[\alpha_i|\Phi_i,\Phi_j>\widehat{\Phi}\right] \\ &-.\widehat{\Phi}E\left[\alpha_i\chi(\theta_j)|\Phi_i,\Phi_j\leq\widehat{\Phi},\mu_i\right]. \end{aligned}$$

and

$$\begin{aligned} V^0\left(\Phi_i,\widehat{\Phi},\mu_i\right) &\equiv (1-p)\left[\widehat{\Phi}+\left(1-\widehat{\Phi}\right)(1-p)\right]u(1) \qquad \text{(B.4)} \\ &+\left(1-\widehat{\Phi}\right)p^2u(0)+p\widehat{\Phi}E\left[u\left(\tau\left(\Phi_j,\widehat{\Phi},1-p\right)\right)|\Phi_j\leq\widehat{\Phi}\right] \\ &+\left(1-\widehat{\Phi}\right)p(1-p)\left\{E\left[u\left(\tau\left(\Phi_j,\widehat{\Phi},1\right)\right)|\Phi_j>\widehat{\Phi}\right]+u\left(1-\tau\left(\Phi_i,\widehat{\Phi},1\right)\right)\right\} \\ &+\widehat{\Phi}(1-p)u(1-p)E\left[\alpha_i|\Phi_i,\Phi_j\leq\widehat{\Phi}\right] \qquad \text{(B.5)} \\ &+\widehat{\Phi}pE\left[\alpha_iu\left(1-p-\tau\left(\theta_j,\widehat{\Phi},1-p\right)\right)|\Phi_i,\Phi_j\leq\widehat{\Phi}\right] \\ &+\left(1-\widehat{\Phi}\right)\left\{p^2u(0)+(1-p)^2u(1)\right\}E\left[\alpha_i|\Phi_i,\Phi_j>\widehat{\Phi}\right] \qquad \text{(B.6)} \\ &+\left(1-\widehat{\Phi}\right)p(1-p)\left\{\begin{array}{c} E\left[\alpha_iu\left(1-\tau\left(\Phi_j,\widehat{\Phi},1\right)\right)|\Phi_i,\Phi_j>\widehat{\Phi}\right] \\ +u\left(\tau\left(\Phi_i,\widehat{\Phi},1\right)\right)E\left[\alpha_i|\Phi_i,\Phi_j>\widehat{\Phi}\right] \end{array}\right\} \\ &-\widehat{\Phi}E\left[\alpha_i\chi(\theta_j)|\Phi_i,\Phi_j\leq\widehat{\Phi},\mu_i\right]. \end{aligned}$$

which both depend on μ_i but only through the caring for the partner's takeup cost. As this term is the same in both value function, they cancel out from the net value of taking up insurnace, that is $V\left(\Phi_i,\widehat{\Phi}\right)\equiv V^1\left(\Phi_i,\widehat{\Phi},\mu_i\right)-V^0\left(\Phi_i,\widehat{\Phi},\mu_i\right)$ is naturally independent of μ_i. The definitions of the anticipated equilibria and the full equilibrium remain unchanged as do Lemma 2 and Proposition 1.

Instructions to participants

Before starting the actual experiment, the participants received a central explanation and an individual explanation by their enumerator using schematic representations of the experiment such as shown in Figure B.1.

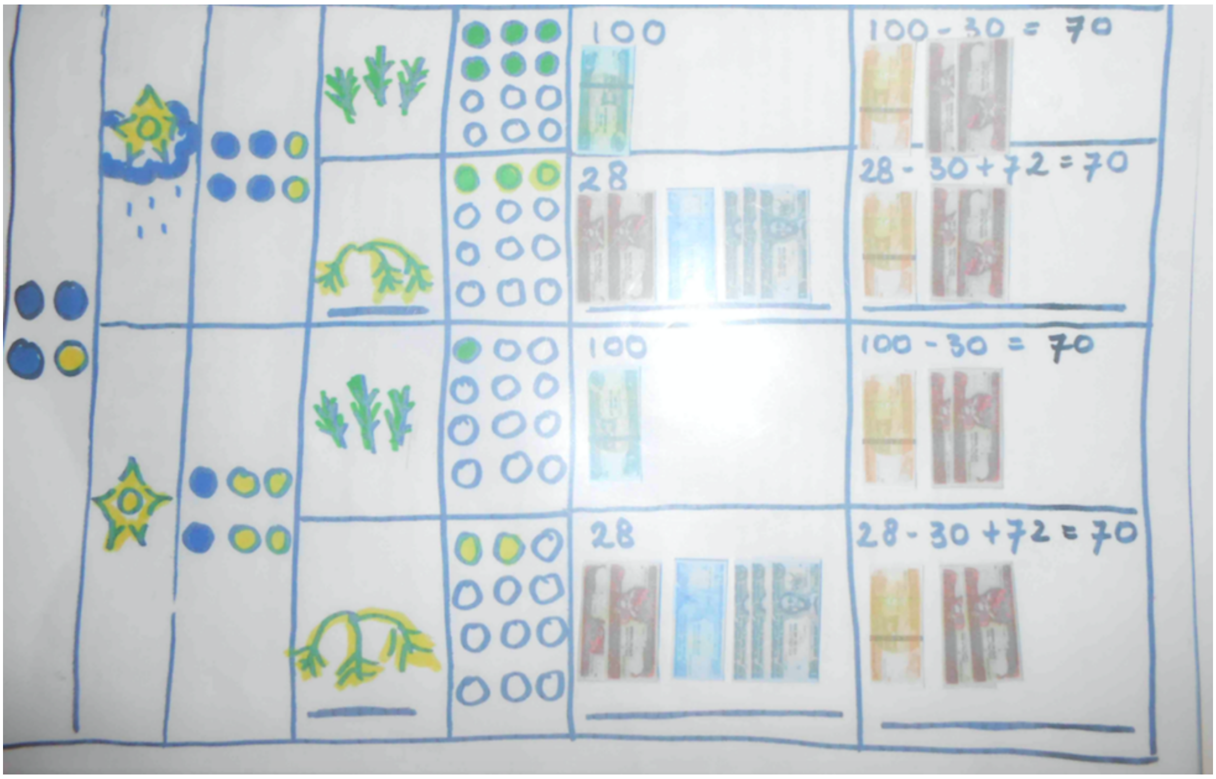

Figure B.1: Probabilities and payoffs with and without insurance

Note: The column on the left represents the four tokens with a 1/4 probability of drought. This determined if the second-stage dice (column 3 from left) either had a 1/3 probability of loss, or a 2/3 probability of loss. The 5th column presents the overall probabilities, the 6th column the payoff in ETB without insurance and transfers, and the 7th column the payoff in ETB with insurance (and without transfers).

The empirical distribution of transfers

For each of the 189 donors, we observe three chosen transfer levels $\{\tau_i^b, \tau_i^0, \tau_i^1\}$. The lowest observed transfer is zero while the highest observed transfer is 36. Table B.1 shows the full empirical distribution of transfers by treatment arm across the 189 observed donors. As can be seen from the table, transfers are frequently chosen as multiples of five. In addition to showing the count distribution for each transfer, the table also provides the empirical cumulative distribution function (CDF). Inspection of the CDFs reveal that they - with only one exception at the top end of the support – exhibit first order stochastic dominance; for any given τ in the empirical support, $\Pr\left(\tau_i^1 \leq \tau\right) > \Pr\left(\tau_i^0 \leq \tau\right) > \Pr\left(\tau_i^b \leq \tau\right)$.

Risk preferences

To assess subjects' risk preferences the participants played an incentivised ordered lottery selection experiment adopted from Binswanger (1981). In this experiment the subjects were asked to make a choice between six lotteries in the gain domain, each with a fixed probability of 1/2. The available choices, denoted $r_i \in \{0, ..., 5\}$, correspond to increasing levels of risk aversion, starting at risk neutrality (0) and going to extreme risk aversion (5). The ordered lottery options are outlined in Table B.4. The final column gives a risk aversion range associated with each available choice option, calculated based on Constant Relative Risk Aversion (CRRA) preferences and expected utility theory. As subjects were only required to make one choice among the different lotteries with a fixed probability, the Binswanger lottery is considered a simple procedure which is easily understood by subjects. The final payoffs for the ordered lottery were determined by drawing coloured tokens from an envelope with the colours corresponding either to the low amount or the high amount in the lottery. For simplicity we will refer to the ordered choice measure as "risk aversion", though it should be kept in mind that the scale $\{0, 1, ..., 5\}$ has only an ordinal interpretation, not a direct cardinal one.

The final column of Table B.4 illustrates the distribution of choices in the ordered lottery selection experiment used to assess farmers' risk attitudes. The most frequently observed choice was the most risky option with the highest expected value.

Table B.3 presents OLS regressions of the baseline transfer amount, τ_i^b, and of risk aversion (ordered lottery choice) $r_i \in \{0, ..., 5\}$. The first regression also includes r_i as a potential determinant of τ_i^b. The table shows that the observed variation in the baseline transfer is not explained by any of the observed individual and farm characteristic. In particular, the regression finds no relation between the baseline transfer and our measure of risk aversion.

The second column of Table B.3 reports a regression of r_i on the same demographic and farm characteristics, but finds no strong correlation. Recall also that the results presented in Table 2 found no strong association between individual risk aversion and insurance uptake (among recipients) and beliefs about uptake (among donors).

The findings thus suggest that risk attitude is a personal characteristic that is distinct from other sources of individual heterogeneity driving variation in uptake behaviour and in beliefs about uptake behaviour. This interpretation is further strengthened by the results presented in Table B.4. The first two columns of the table replicates columns 1 and 3 of Table 4. In the final column of Table B.4 the interactions between treatment condition and donor beliefs are replaced with corresponding interactions with donor risk aversion.

The regression shows that more risk averse donors reduce their transfers more in response to the recipient receiving an insurance offer, but the size of the reduction is not related to whether the offer was accepted or rejected. This is in stark contrast to the main finding of a sharp reduction in the transfer in response to the donor rejecting insurance by donors who firmly anticipate uptake.

Table B.1: The empirical distribution of transfers

	Baseline (τ_i^b)		**Ins. Rejected** (τ_i^0)		**Ins. Accepted** (τ_i^1)	
Transfer	Count	Cum.	Count	Cum.	Count	Cum.
0	21	11.1	67	35.4	104	55.0
1	0	11.1	0	35.4	0	55.0
2	0	11.1	0	35.4	2	56.1
3	0	11.1	0	35.4	0	56.1
4	1	11.6	1	36.9	0	56.1
5	20	22.2	14	43.4	17	65.1
6	0	22.2	0	43.4	0	65.1
7	0	22.2	0	43.4	0	65.1
8	0	22.2	0	43.4	0	65.1
9	0	22.2	0	43.4	0	65.1
10	56	51.9	44	66.7	44	88.4
11	0	51.9	0	66.7	0	88.4
12	0	51.9	1	67.2	0	88.4
13	0	51.9	0	67.2	0	88.4
14	0	51.9	0	67.2	0	88.4
15	12	58.2	10	72.5	11	94.2
16	0	58.2	0	72.5	0	94.2
17	0	58.2	0	72.5	0	94.2
18	8	62.4	3	74.1	0	94.2
19	0	62.4	0	74.1	0	94.2
20	29	77.8	26	87.8	5	96.8
21	0	77.8	0	87.8	0	96.8
22	2	78.8	0	87.8	0	96.8
23	0	78.8	0	87.8	0	96.8
24	0	78.8	0	87.8	0	96.8
25	6	82.0	6	91.0	1	97.4
26	0	82.0	1	91.5	0	97.4
27	0	82.0	0	91.5	0	97.4
28	2	83.1	1	92.1	1	97.9
29	0	83.1	0	92.1	0	97.9
30	29	98.4	14	99.5	4	100
31	1	98.9	0	99.5	0	100
32	0	98.9	0	99.5	0	100
33	0	98.9	0	99.5	0	100
34	0	98.9	0	99.5	0	100
35	2	100	0	99.5	0	100
36	0	100	1	100	0	100

Note: The table shows the complete empirical distribution of donor-choices of transfers for each treatment condition. The "baseline" transfer τ_i^0 would be provided to the recipient in the case the latter was not offered insurance, $m_j = 0$. The "insurance rejected" transfer would be provided to the recipient in the case the latter was offered insurance but rejected it, $m_j = 1$ but $z_j = 0$. The "insurance accepted" transfer would be provided to the recipient in the case the latter was offered insurance and accepted it, $m_j = 1$ and $z_j = 1$.

Table B.2: Ordered lottery selection experiment

Lottery Option	**Prospect**	**Expected payoff**	**Risk aversion class**	**Risk aversion Risk aversion**	**Frequency of choice**
0	(160, p=0.5; 0)	80	neutral-negative	(0.00; $-\infty$)	0.282
1	(150, p=0.5; 10)	80	slight-neutral	(0.32; 0.00)	0.154
2	(120, p=0.5; 20)	70	moderate	(0.81; 0.32)	0.137
3	(90, p=0.5; 30)	60	intermediate	(1.74; 0.81)	0.145
4	(75, p=0.5; 35)	55	severe	(7.51; 1.74)	0.137
5	(40, p=0.5; 40)	40	extreme	($+\infty$; 7.51)	0.145

Note: To assess subjects' risk preferences farmers played an incentivised ordered lottery selection experiment adopted from Binswanger (1981). In the experiment subjects were asked to make a choice between six lotteries in the gain domain, with a fixed probability of 1/2. The values are in Ethiopian Birr. The available choices, denoted $\{0, ..., 5\}$, correspond to increasing levels of risk aversion, starting at risk neutrality (0) and going to extreme risk aversion (5). The risk aversion range is calculated based on Constant Relative Risk Aversion (CRRA) preferences and expected utility theory. The final column provides the empirical distribution of choices.

Table B.3: Regression of the donor-chosen baseline transfer on individual and farm characteristics

	Baseline Transfer
Age in years	0.001
	(0.049)
Literate	-1.607
	(0.967)
Education	-0.449
	(0.417)
Female	1.032
	(1.652)
Married	0.261
	(1.115)
Number of adults in household	0.188
	(0.443)
Number of children in household	0.199
	(0.372)
Tropical Livestock Units (TLU)	-0.016
	(0.024)
Land size in Tsemdi	0.884*
	(0.435)
Farm land irrigated	-1.656
	(1.477)
Probability of loss own farm $25 - 50\%$	0.099
	(0.697)
Risk aversion	-0.272
	(0.471)

Note: Column 1 presents the regressions of baseline transfers by the donor on each individual covariate separately. The number of observations in each regression is $N = 160$, due to some missing variables except for the case of risk aversion where $N = 108$ due the underlying lottery selection experiment not being run in the first 7 of the 18 sessions. (see the Online Appendix for further details). "Risk aversion" is a categorical variable from "0" to "5" with "0" being risk neutral and "5" being the most risk averse (See the Table B.4 in the Online Appendix for further details). "Education" is a categorical variable from "0" to "8" with "0" being no education, and "8" being university. "Tropical Livestock Units (TLU)" is a weighted count of the number of livestock. One "Tsemdi" is 0.25 hectares. "Probability of experiencing $25 - 50\%$ crop loss" reports the answer to the question *How many years out of the last ten years did you experience* $25 - 50\%$ *crop loss?*, divided by ten. Clustering of standard errors in all regressions at the session level (n=18). Significance levels $p < 0.10^{*}$, $p < 0.05^{**}$,$p < 0.01^{***}$

Table B.4: Fixed effects regressions of transfers on treatment condition with interactions with risk aversion and control variables

	(1)	(2)	(3)	(4)	(5)
Baseline (α)	14.84	15.31	14.94	16.43	15.93
	(0.49)	(0.49)	(0.49)	(0.52)	(0.51)
Ins. Rejected (β_0)	-4.71***	-0.34	10.19*	-3.72	4.31
	(0.77)	(2.71)	(5.79)	(2.80)	(7.19)
Ins. Accepted (β_1)	-9.68***	-10.63***	-10.88	-13.68***	-17.38**
	(0.92)	(3.44)	(8.19)	(3.16)	(8.10)
Donor Belief × Ins. Rej.		-6.79**	-6.91*	-7.14**	-7.20*
		(3.52)	(3.67)	(3.80)	(4.45)
Donor Belief × Ins. Acc.		-0.28	0.52	-0.66	-0.87
		(4.25)	(4.41)	(3.92)	(4.28)
Risk Aversion × Ins. Rej.				1.29**	1.04**
				(0.49)	(0.50)
Risk Aversion × Ins. Acc.				0.91*	1.03
				(0.53)	(0.50)
All treatment*control interactions			v		v
Observations	567	486	468	324	306
Subjects	189	162	156	108	102

Note: The dependent variable is the observed chosen transfer level. Each subject makes three transfer decisions. Each regression includes individual donor fixed effects. The first and second column restate Columns 1 and 3 from Table 4. In Column 3 all the interactions between the treatment and all control variables are added. The number of subjects reduces because of missing variables on controls. Column 4 presents the results for the interaction with risk aversion between – as measured by the ordered lottery option choice in the set $\{0, ..., 5\}$ described in Table . Here risk aversion is interacted with the dummy for the observed transfer being intended for the case where the recipient was offered insurance but rejected it ("Insurance Rejected") and with the dummy for the observed transfer being intended for the case where the recipient was offered insurance and accepted it ("Insurance Accepted"). The number of observations is lower in this case as the lottery choice experiment was run only in 11 of the 18 sessions. In Column 5 we add the interaction with the donor's belief about the insurance take-up decision by the recipient. In Column 6 we also add all interactions between the treatment and all control variables. The number of subjects reduces because of missing variables on controls. Significance levels $p < 0.10^{*}$, $p < 0.05^{**}$, $p < 0.01^{***}$.