Formal Insurance and the Dynamics of Social Capital: Experimental Evidence from Uganda

Francesco Cecchi, Jan Duchoslav and Erwin Bulte*

Development Economics Group, Wageningen University, Netherlands.

* Corresponding author: Fax: +31 317 484 037, Email: erwin.bulte@wur.nl

Abstract: We explore how the introduction of formal insurance affects the within-village dynamics of social capital in south-western Uganda. We proxy social capital by contributions in a public goods game. Consistent with existing evidence, our data suggests formal insurance crowds out social capital. However, and surprisingly, it is not the wealthy (i.e. those individuals adopting formal insurance) who reduce their contributions to the public good. Instead, social capital erodes because the uninsured, or the local poor, lower their contributions. This is consistent with "weapons of the weak" theories, emphasising social embeddedness. The "poor" are unable to benefit from formal insurance themselves and fear they will lose out as informal sharing networks start to unravel. They may use the public goods game to signal their dismay, and to punish the "rich" who may (threaten to) eventually opt out of these networks.

Keywords: insurance, social capital, informal institutions, "weapons of the weak", Africa

JEL Codes: D1, O1, Z1

1. Introduction

Institutions are constraints devised by humans to shape human interaction (North, 1990: 3). This broad definition captures both formal and informal institutions, where the former are often treated as exogenous constraints, enforced by an outside party (possibly "the state"), and the latter are endogenous constraints—self-enforcing rules representing the sub-game perfect equilibrium of a repeated game (e.g. Greif 1993, Aoki 2001a,b). While recent empirical work has identified institutions as a key determinant of economic performance (e.g. Rodrik et al. 2004), much remains unknown about how institutions evolve over time, or about the interaction between different (types of) institutions.

In this paper we ask how formal institutions affect informal ones. This topic is gaining importance as, globally, systems of formal institutions are expanding. For example, global value chains are penetrating further into societies hitherto oriented towards subsistence activities; the formalisation of land rights increasingly affects customary institutional tenure arrangements; and the expanding reach of the state and formal court system is altering informal judicial institutions. The current wave of experimentation with (index) insurance products in environments characterised by informal sharing arrangements represents another example. While some theoretical work exists to analyse how (exogenous) changes in formal institutions affect the equilibrium of repeated games (e.g., Aoki 2001b), empirical work in this domain remains very scarce. Roland (2004) describes the interaction between slow- and fast-moving institutions and argues that, depending on the context, specific institutions may be complements or substitutes (see also Williamson 2009). Institutional innovations in one domain may therefore crowd out, or solidify, existing institutional arrangements.[1]

In this paper we seek to enhance our understanding of the impact of a specific formal institutional innovation on local cooperation ("social capital") using experimental methods.

[1] For recent experimental work along these lines, refer to Chandrasekhar et al. (2013).

We focus on the provision of insurance—a domain relatively well-studied by economists. Rural producers in developing countries are exposed to various shocks, and typically are better off when pooling their risks (in particular when the co-variation of risks across individuals is modest or absent). Since, until recently, prohibitive transaction costs typically precluded the writing of formal insurance contracts, rural producers by and large depended on informal insurance arrangements to secure their livelihoods (e.g., Townsend 1994, Udry 1996, De Weerdt and Fafchamps 2011). Such sharing could take various forms, including redistribution within friendship or kinship networks (e.g., Fafchamps and Gubert 2007, Alger and Weibull 2010), or transfers in patron-client relationships (Richards 1996). In recent years, however, various agencies have experimented with the provision of formal insurance for rural households, based on written contracts and possibly outside enforcement. This development was facilitated by improvements in communication technology, lowering transaction costs, but also by the creation of "new" insurance products such as index insurance.

Insofar as formal and informal insurance are "substitutes", one might expect that expansion of formal insurance possibilities will crowd out informal insurance arrangements. A small literature seeks to empirically test this hypothesis, providing some support for it. Dercon and Krishnan (2003) find that public transfers in the form of food aid crowd out informal sharing in rural Ethiopia.[2] Landmann et al. (2012) use data from the Philippines to show that formal insurance lowers voluntary transfers among members in social networks. Klohn and Strupat (2013) examine the link between the provision of formal health insurance and informal transfers in Ghana, and find that formal insurance reduces both the probability of

[2] Also see Bahre (2011), who examines the relation between formal financial arrangements and personal networks in post-apartheid South Africa, finding that increasing redistribution created frictions within networks.

making transfers as well as amounts transferred. Lin et al. (2012) confirm the crowding out thesis in a laboratory setting.[3]

The main objective of this paper is to empirically explore how the introduction of formal health insurance affects within-village social capital dynamics in a sample of Ugandan villages. We seek to extend evidence reported by Klohn and Strupat (2013), the only other paper considering the implications of formal health insurance for informal institutions. To this end, we first compare the behaviour of villagers with and without access to formal health insurance (i.e. an intention-to-treat effect at the village level). We proceed by disentangling behavior of adopters and non-adopters. Unlike existing work, we consider a voluntary insurance program with imperfect uptake—allowing us to probe *intra*-village implications. Moreover, we do not use informal transfers as our measure of social capital. Instead, our main dependent variable is based on behaviour in public good (PG) games. The PG game captures the ability of communities to coordinate on first-best outcomes, and represents a well-known measure of social capital at the village level (e.g. Fearon et al. 2009, Voors et al. 2011). Following Klohn and Strupat (2013) and Morten (2013), one may hypothesize that formally insured village members depend less on their fellow villagers to sustain their livelihoods and, as a consequence, invest less in social relations.[4] If so, the result will be erosion of social capital, translating into lower contributions to the local public good.

In areas with access to formal insurance, we find that uptake is far from uniform, and skewed towards the sub-sample of wealthier villagers. We also find that average contributions to the public good are indeed lower in areas with a formal insurance system in place. These results corroborate predictions of the game theoretical paradigm (outlined

[3] A related literature concerns the effects of migration (remittances) as a mechanism to provide insurance. For example, Morten (2013) establishes that temporary migration decreases informal risk sharing.

[4] Of course there are other reasons why the introduction of formal insurance (or storage) possibilities may cause adopters to opt out of informal institutions or networks. Klohn and Strupat (2013) discuss that formal institutions may crowd out altruistic behaviour (see Bowles 2008), or may reduce (the bite of) social sanctions associated with exit (see Grimm et al. 2013).

below), as well as the empirical findings mentioned above. Next, we zoom in on within-village social capital dynamics, documenting patterns in the data that are harder to explain. We find that lower aggregate contributions to the public good in areas with access to the formal insurance are *not* due to the withdrawal of insurance adopters. Instead, reduced average contributions are explained by declining contributions of non-adopters. We speculate this behaviour serves as a signal of their displeasure of being left behind after the wealthy threaten to opt out of informal sharing networks. If formal insurance is only available to a (wealthy) sub-sample of the population, who could then choose to exit informal insurance networks, then villagers left behind may lose. They would unambiguously be worse off if their informal insurance options deteriorate while they cannot benefit from formal insurance.

The interpretation of reduced contributions as a signal, or warning, is consistent with insights of the sociologist Mark Granovetter (1991), who emphasises the importance of "social embeddedness" (i.e. social interaction beyond economic exchange), and supports insights of the anthropologist James Scott (1985), who studied the consequences of mechanisation for social relations in a rice producing village in Malaysia. Scott coined the phrase "weapons of the weak" to describe how the poor resisted their degradation in the village hierarchy and culture. We return to these models below.

The rest of this paper is organised as follows. In section 2 we outline and illustrate the conventional economic perspective on the evolution of informal institutions (in response to changes in the broader environment). We then complement this perspective with the "weapons of the weak" argument advanced by Scott (1985). In section 3 we provide context regarding the case study, and describe the insurance intervention as implemented by a local NGO. In section 4 we summarise our data, outline our identification strategy, and formulate four research questions. Section 5 contains our empirical results, and the conclusions ensue.

2. The interaction between formal and informal institutions

We first outline a simple economic perspective on the interaction between formal and informal institutions, which focuses on consequences in a specific domain of interest (typically related to some form of exchange). This perspective lends itself naturally to game-theoretic analysis, and economists have developed a coherent framework in which informal institutions are seen as the equilibrium outcomes of repeated interactions—outcomes that are persistent over time, shaping expectations and gradually evolving into norms of appropriate behaviour. See, for example, Aoki (2001b) for a treatment of institutions as endogenous and self-enforcing equilibrium outcomes of a repeated game.

Economists have studied the evolution of informal insurance arrangements as alternative insurance opportunities emerge. Informal insurance via gifts and transfers occur within networks of family members (or friends) because of altruism, and may involve support to deal with persistent shocks (chronic illness or disability—see De Weerdt and Fafchamps 2011). Informal insurance may also be motivated by expected reciprocity among individuals (or households) in a context of repeated interaction (e.g., Kimball 1988, Coate and Ravallion 1993, Ligon et al. 2001, de Weerdt and Fafchamps 2011). The theoretical literature has emphasized that such non-altruistic sharing arrangements should be self-enforcing; individuals are willing to help others facing a temporary shock because of the credible promise of reciprocity in the future (so that participation constraints automatically limit the extent of risk sharing that is possible). The voluntary participation constraint for individual *i* may be written as:

$$u_i(c_{it} - h_{it}) - u_i\left(c_{it} + T_{ijt} - h_{it}\right) \leq E_{t|hit,hjt}\left[\sum_{s=1}^{\infty} \beta^s \left\{u_i(c_{i,t+s} + T_{ij,t+s} - h_{i,t+s}\right) - u_i(c_{i,t+s} - h_{i,t+s})\right\}\right] + A_{ij}, \quad (1)$$

where u_{it} denotes concave utility of individual *i* at time *t*; *c* denotes consumption; T_{ij} is a transfer from *i* to *j* (a specific transfer from a menu, depending on the realization of health shocks to individuals *i* and *j*); *h* denotes the value of a health shock; *E* is the expectations operator; β is the (common) discount factor; and A_{ij} is a measure of altruism, or the utility obtained by individual *i* from helping individual *j*. The left hand side of (1) captures the temptation to renege on a sharing obligation, or the immediate gain in utility from not transferring the transfer T_{ij} to individual *j*. This short-term benefit should be balanced against the loss of foregoing the (expected) potential benefits from sharing in the future (in all periods *s* that follow).

How does the emergence of formal insurance affect the participation constraint? An individual who is expelled from the insurance network now has the option to adopt formal insurance – paying a fixed fee τ every period and receiving payment *F* in case of a health shock. This implies we can rewrite (1) as:

$$u_i(c_{it} - h_{it}) - u_i\left(c_{it} + T_{ijt} - h_{it}\right) \leq E_{t|hit,hjt}\left[\sum_{s=1}^{\infty} \beta^s \left\{u_i(c_{i,t+s} + T_{ij,t+s} - h_{i,t+s}\right) - u_i(c_{i,t+s} - \tau + F_{i,s} - h_{i,t+s})\right\}\right] + A_{ij}. \quad (1`)$$

Since an actuarially fair insurance product improves the autarky outcome of adopters in the future, it decreases the right-hand side of (1). This implies the set of self-enforcing informal insurance transfers decreases (which may be inconsequential for sufficiently large values of *A*, or if the self-enforcement constraint does not "bind"). Intuitively, since individuals have access to a substitute insurance product tomorrow (other than transfers from peers), it is more tempting to renege on obligations today and opt out of the network, so that only a menu of small transfers can now be supported as an equilibrium. As a result, insurance options for non-adopters deteriorate.

The main message is that substitute insurance mechanisms lower the value attached to informal sharing arrangements (for those able to adopt the substitute). Substitutes could be formal insurance, as above, but alternatives exist. For example, Ligon et al. (2000) focus on the implications of self-insurance via storage, which strictly increases the value of autarky. As above, individuals who were previously (almost) indifferent between participating in the sharing network and autarky will now renege when they have the option to store, and subsequently opt out of the network. While their welfare improves as a result, the utility of individuals remaining in the network decreases unambiguously. They are worse off because the network shrinks and loses part of its ability to absorb shocks. Ligon et al. (2000) demonstrate that introducing the possibility of storage may even reduce overall welfare. Migration (remittances) may provide yet an alternative substitute mechanism to protect households from health shocks, and Morten (2013) demonstrates that migration tends to decrease insurance provided via informal networks.

The economic perspective thus proposes that the expansion of formal institutions, insofar as they provide a substitute for informal institutions, may undermine these informal institutions. The economic system shifts from one sub-game perfect equilibrium to another, reflecting the new choice sets for economic agents. In particular, "adopters" of the formal institution may opt out of pre-existing arrangements. In the process, distributional issues emerge and net welfare may decrease as a result. Is this a complete characterisation of the evolution of societies?

A broader perspective emerges if we recognise that economic agents are social creatures that also interact in other domains than the economic one. In the words of sociologist Granovetter (1995), economic transactions are "socially embedded." Aoki (2001a, p.98) writes that "the economic transaction domain is embedded in a social exchange domain in which the same members repeatedly interact socially and invest in, and enjoy returns from,

social capital." This perspective can be worked out formally using game theory, by linking multiple games and expanding the payoff structure. For example, Aoki (2001a) demonstrates that linking an economic exchange and social interaction game may expand the set of equilibria that can be supported in the exchange game.

There are alternative approaches to study social embeddedness. For example, the anthropologist Scott (1985) uses a descriptive approach to study the consequences of mechanisation in rice farming in a Malay village—a process inviting consolidation of farms (e.g. by inviting landowners to start reneging on long-term tenure arrangements) and dramatically reducing demand for hired labour. The result was "proletarisation" of small farmers and landless labourers—the creation of an underclass of society members whose well-being was increasingly inconsequential for upper strata of society (and whose interests were increasingly ignored). This is the unravelling of social networks caused by selective exit of the privileged (i.e., the adopters), more or less along the lines discussed above. However, the story does not stop here. Scott demonstrates that "losers" in one sphere of interaction (e.g. the labour market) are fully aware of their situation, resent it, and seek to remind the adopters of their historical responsibilities and social obligations by retaliation in other spheres of interaction—including everyday social life.

Scott (1985) investigates such strategies in detail. Peasants recognize their limited (economic, political and symbolic) power, and typically prefer non-rebellious and non-revolutionary acts of resistance. Typical “weapons of the weak” consist of low-key recalcitrance, foot dragging, dissimulation, false compliance, pilfering, feigned ignorance, chicanery, slander, arson, and acts of minor sabotage. Resistance strategies range from gossip and character assassination to strikes (such as when machines break down and landowners suddenly need labour to harvest their fields) and boycotts of social activities such as weddings and political rallies organised by those well-off. More in general, resistance signals a reduced

overall tendency to cooperate. This indicates a deterioration of local levels of social capital, undermining the ability of communities to coordinate on first-best outcomes.

Do these insights extend from the context of Malaysia to Africa, and from the context of mechanisation to insurance? In what follows we test whether formal insurance affects voluntary contributions of villagers to the local public good—distinguishing between those adopting insurance and those not adopting insurance, faced with a potentially shrinking informal network. To empirically probe this issue we organised behavioural games in a sample of rural Ugandan communities.

3. The case study: Health insurance in Uganda

Approximately half the population in Uganda is below 14 years of age, and this population is expected to double in size in the next twenty years (UNESA, 2012). To help sustain strong post-war economic recovery during the last decade, Uganda is increasingly focusing on health interventions and the accumulation of human capital (World Development Report, 2011).

We focus on Kitagata sub-county, located in the South-Western Sub-region of Uganda. A local not-for-profit organization called Save for Health Uganda (SHU) has recently implemented a health micro-insurance project across four parishes in Kitagata, with the ultimate mid-term goal of covering the entire sub-county.[5] In what follows, we refer to households from these parishes as having "access" to formal health insurance—i.e. in these parishes households actively decided whether to adopt insurance, or not. Each village in the covered parishes is encouraged and facilitated to create a so-called Community Health Financing (CHF) scheme, which provides health insurance to member families. Members receive an insurance card, allowing access to all services provided by contracted facilities.[6]

[5] Since then, Kitagata Sub-county has been administratively divided into two sub-counties: Kitagata and Kasaana. SHU however keeps working in both sub-counties with a single programme.

[6] One private hospital and two public healthcare facilities.

These services include transport to the hospital in case of delivery, ante-natal care, out-patient services, admission services and surgery (SHU, 2013).

Although there was slight variation with respect to the starting date of village level schemes, SHU required villages within the same parish to begin simultaneously, ensuring relatively homogeneous up-take rates. When we collected our data in August 2012, all the randomly selected villages from areas with access to the insurance had a running scheme, to which approximately 53% of the families had subscribed. The great majority of the villagers in access areas (some 95%) indicated to be familiar with CHF schemes, while in parishes without access to the formal insurance around 56% of the people interviewed had heard about the schemes, but were aware that it was not (yet) available to them.[7] On average, member households were expected to pay just above 26,000 USh (or $10) to cover the yearly insurance premium, with some variation depending on village and family size. Premiums were not sufficient to cover insurance costs, which are subsidized by international donors and sponsors. Nonetheless, only 18% of the participating families had been able to pay the full yearly premium to that date, with average payment rates hovering around 34%.[8] Families that have not fully paid the premium do not yet qualify for compensation; so many families currently have one foot in the formal system but also need to continue investing in informal arrangements.

We believe there is considerable demand for formal health insurance schemes, but that paying for the premium remains a challenge for many families. The latter is confirmed by many open-ended exit interviews. While we did not collect hard evidence on the pre-existence of informal social arrangements of mutual insurance, anecdotes complement the

[7] Notably, SHU had already undertaken informational and sensitization meetings in 2 parishes in no access areas, at the time of our fieldwork and, while the scheme was neither active nor running, the insurance was scheduled to start there in the near future.

[8] Dekker and Wilms (2010) find that participants to a similar private health-insurance scheme in five rural and two urban communities in Uganda face comparable difficulties in paying the premium: only 37% of participating households were able to pay.

(qualitative) literature on local informal arrangements (Taylor et al., 1996; McDonald et al., 1999), stressing the importance of relatives, neighbours and friends in providing financial support in times of hardship.[9] We interpret this context as one of being in institutional flux, in which a considerable share of the local population appears "in limbo" between alternative insurance modalities, as one in which "signalling" by discontent fellow villagers may be effective.

4. Experimental identification, data, and design

The health insurance scheme was implemented according to a pipeline approach: while the ultimate aim is to establish a running CHF in every parish, logistical constraints forced the implementing agency to gradually roll out their intervention. Some parishes are therefore treated earlier than others, and we refer to households living in parishes where the intervention had not taken place yet as not having access to formal insurance. Strictly speaking, the selection of (early) access parishes was arbitrary and did not follow an explicit randomisation procedure, but not surprisingly access and no-access households are very similar across almost all dimensions we measured. Abundant anecdotal evidence suggests access parishes are comparable to no-access parishes, and that there are more differences between villages within the same parish, than between parishes. Moreover, villages with access are not significantly different from their counterparts in terms of total number of households, distance and time from a major road, and from the Sub-County headquarters (see Table 1).[10]

[9] An open-ended questionnaire highlighted that people help each other in times of illness, contributing to hospital bills and helping the family financially though donations of food and money, or by transporting sick persons to the hospital. In the words of one respondent, "here the story is that people help each other […] when they are sick, and in case of unlucky events."

[10] Both distance (Km) and time (minutes) where measured following the route most commonly used by locals. We used a motorbike taxi as reference for time, as it represents the most commonly used motorized vehicle by locals, as well as the means of transport typically used by SHU extension agents.

We randomly selected 21 villages from three access parishes, and another 23 villages from five neighbouring parishes (in what follows: no-access villages). Four of these parishes are located in the same sub-county as the access parishes (Kitagata), and one parish containing five villages is located in neighbouring Mitooma sub-county, bordering the largest parish with an active insurance scheme. In each village we first constructed a census of all households, and then randomly selected 10 households per village. After an extensive household survey, we randomly selected one adult family member to participate in our lab-in-field experiments.[11] We have no relation with the NGO offering the insurance product, and to avoid gift exchange and demand effects we did not emphasize the insurance program in our sessions.

Table 1 summarises the household data, split out between the access and no-access households. We first establish that access and no-access respondents are indistinguishable according to most socio-economic dimensions—the two groups appear balanced. This is consistent with information given to us by the implementing NGO – they did not use a specific targeting rule when prioritising villages to enrol in the program. Age of the household head is the only variable that differs, but this difference is small and presumably caused by chance. A key variable for our purposes is the so-called wealth factor. This variable is constructed by factoring out a wealth index from a series of dummy variables related to asset ownership (i.e. phone, radio, television, generator, bicycle, motorbike and car) and house features (iron roofing, brick walls and cement floors) locally perceived as primary indicators of wealth. The average asset index score is not significantly different in access and no-access villages. Also, for the full range of socio-economic variables, bias-corrected

[11] Enumerators made a list of each eligible family member before randomly selecting one name through a transparent ballot. Households were informed that the selected participant would be the only accepted household representative in the experiment, and that failure to comply with the rule would result in the exclusion of the household from the study. 44,5% of selected participants where female (see Table 1) and compliance averaged 93%. The plausible non-random attrition bias is discussed in section 5.

variance estimates within parishes are greater than those across parishes. For definitions of the remaining variables, refer to Appendix I.

Table 1. Group means of socio-economic variables

Variables	No-access parishes		Access parishes		Diff.	Std. Err.
	N	Mean	N	Mean		
Village size (households)	23	65.13	21	58.05	-7.08	4.27
Time to main road	23	6.13	21	7.24	1.11	1.56
Distance from main road	23	2.33	21	2.47	0.14	0.66
Time to sub-county town	23	15.70	21	14.67	-1.03	3.18
Distance from sub-county town	23	5.50	21	4.31	-1.19	0.89
Female participant	230	0.47	210	0.42	-0.05	0.05
Single	216	0.05	207	0.03	-0.02	0.02
Married/Engaged	216	0.79	207	0.79	0.00	0.04
Widowed	216	0.15	207	0.16	0.01	0.02
Male household head	230	0.75	210	0.76	-0.01	0.04
Age household head	216	46.61	199	50.23	3.61**	1.54
Education household head	230	5.31	209	4.95	-0.36	0.41
Household size	230	6.13	210	6.05	-0.08	0.23
Mothers in house	230	0.74	210	0.79	0.05	0.41
Watch TV weekly	230	0.87	210	0.88	0.01	0.03
Read newspaper weekly	230	0.24	210	0.24	0.00	0.04
Radio	230	0.91	210	0.91	0.00	0.03
Phone	230	0.84	210	0.78	-0.06	0.04
Bicycle	230	0.45	210	0.42	-0.03	0.05
Motorbike	230	0.15	210	0.11	-0.04	0.03
Television	230	0.04	210	0.04	0.00	0.02
Car	230	0.04	210	0.04	0.00	0.02
Generator	230	0.02	210	0.03	0.01	0.01
Wealth factor	230	0.04	210	-0.05	-0.09	0.08
House features index	230	1.40	210	1.35	0.05	0.08
Common assets index	230	2.20	210	2.11	0.05	0.08

In terms of analysis, we first seek to explain variation in adoption of health insurance in access villages. Exit surveys identified lack of financial resources as the most frequent reason for opting-out of the insurance scheme. We therefore expect wealthy households to be more likely to join the scheme, creating the sort of within-village divide described by Scott (1985)—non-random adoption of the new technology based on income or wealth. On the other hand, since health status is also likely to vary with wealth, demand for insurance may

also be greater among the non-wealthy. Ultimately the distribution of effective demand for formal insurance across social groups is an empirical question and using the sub-sample of treated parishes (villages), we estimate the following probit models:

$$Pr(I_i=1 \mid W_i) = \alpha + W_i\beta + W_i^{\,2}\gamma + \varepsilon_i\,, \text{ and} \qquad (1)$$

$$Pr(I_i=1 \mid P_i) = \alpha + P_i\beta + \boldsymbol{X'}_i\gamma + \varepsilon_i. \qquad (1')$$

where I_i is a dummy for insurance uptake by household *i*, *W* is a factor of wealth (based on a range of assets, discussed above), *P* is a poverty dummy, ***X'*** is a vector of individual and household characteristics, and ε_i is a random error term. This poverty dummy takes a value of one when a household does not own more than one of the three most common assets (phone, radio, bicycle) and not more than one improved house feature (iron roof, brick wall, cement floor). In words, we explain adoption status by variables measuring wealth or poverty, and our first research question reads as follows:

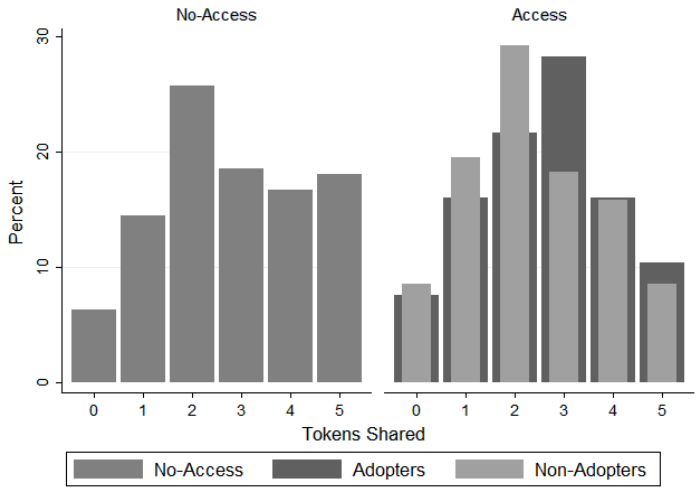
RQ 1*: Are wealthy households more likely to pick up health insurance than poor ones?*

Next, we are interested in explaining the effect of (non-random) adoption of formal insurance on village-level social capital. To construct a measure of social capital, we follow Fearon et al (2009) and organised a lab-in-field experiment, or a standard public goods game (PGG) with five participants. A PPG captures the ability of groups of respondents to overcome free riding incentives. It likely also picks up altruism and trust (as respondents want to avoid outcomes where they feel others have taken advantage of them), as well as the extent to which norms of sharing and cooperation are internalised by villagers. These issues speak to different dimensions of (cognitive) social capital.

We randomly divided our 10 participants from each village into two groups of 5 individuals, carefully explained the rules of the game, and played a trial round. We gave five tokens to each participant, who could then anonymously contribute any integer amount into

the common pot. After participants made their contributions, we doubled the amount in the pot and split this amount equally across all group members. As is well-known, the joint surplus is maximised when all participants contribute the full amount to the pot, but the privately optimal contribution (the Nash equilibrium) is to give nothing. After the trial round, participants were informed that they would play the game an unknown number of times (up to a maximum of 5), and that their pay-out at the end of the game would be based on a randomly selected round (determined by a simple lottery).[12] Payoffs for all participants were based on that same round, and averaged around USD 2.20—or about 2/3 of daily rural household incomes in the Western region, as estimated by the Ugandan Bureau of Statistics.[13] On average, participants without access to the formal insurance shared 2,89 tokens, against the 2,60 tokens shared by adopters, and 2,39 by non-adopters with access. Similarly, only 25,5% of the participants with access made a "high contribution" to the common pot (4 or 5 tokens), against 34,8% of those without access (see Figure 1).

Figure 1. Sharing decisions of participants with and without access to formal insurance



[12] In the absence of group reshuffling, game dynamics of reputation, retaliation and learning are expected to drive contribution decisions in repeated games (Rand et al., 2009). Our intent, however, is to proxy real life dynamics. For this reason our analysis is based solely on the choices performed during the first round of each game version. Successive iterations were performed so that defection is not necessarily the only Nash equilibrium present: players may cooperate on an equilibrium path, provided they are sufficiently interested in future outcomes (Dal Bó, 2005). For the same reason, the exact number of repetitions was not revealed to participants.

[13] http://www.ubos.org/UNHS0910/chapter7.Average%20Monthly%20Household%20Income.html

If formal insurance crowds out informal insurance and reduces cooperation at the local level, then we would expect aggregate (or average) contributions to the common pot to be lower for respondents with access to the formal insurance scheme. Thus, we seek to pick up something resembling an intention-to-treat effect (as did Klohn and Strupat 2013) and estimate the following two models:

$$S_i = \alpha + I_i\beta + [\ \phi(\theta_i / \Phi(\theta_i)\ ] + \varepsilon_i\ , \qquad (2)$$

$$Pr(SH_i=1 \mid I_i) = \alpha + I_i\beta + \varepsilon_i\ , \text{ and} \qquad (3)$$

where S represents the number of tokens shared in the common pot, I is a dummy taking value 1 for respondents living in access villages, ϕ represents the standard normal density function; Φ is the cumulative density function and $\theta_i = z_i\gamma$, where Pr(S is observed) = $\Phi(z_i\gamma)$—a standard Heckman Selection Model that can control for plausible non-random attrition in the experimental sample. In (2), β measures an intention to treat effect. In (3), SH is a dummy for having shared a high amount (that is: 4 or 5 tokens), so this model is estimated using a Probit specification. In words, by estimating (2) and (3) we ask:

RQ 2*: Is the possibility to access a formal insurance associated with lower average contributions to the public good in a PG game?*

We now analyse contributions to the common pot more closely. The conventional economic perspective on the evolution of informal insurance suggests that formal insurance provides a substitute mechanism for the wealthy, who could subsequently choose to opt out of existing informal arrangements and cease cooperation with fellow villagers. The "weapons of the weak" thesis proposes that disgruntled non-adopters signal their dismay at the newly-created dichotomy in the village, which threatens their ability to pool future risks. In other words, both adopters and non-adopters may reduce their contributions to the public good. We

estimate the following 'naïve' models, which resemble (2) and (3) above but distinguish between adopters and non-adopters:

$$S_i = \alpha + A_i\beta + NA_i\gamma + \varepsilon_i\,, \tag{4}$$

$$Pr(SH_i=1 \mid A_i, NA_i) = \alpha + A_i\beta + NA_i\gamma + \varepsilon_i \tag{5}$$

To probe differences in behaviour between adopters and non-adopters, *A* is a dummy taking value 1 for actual adopters (among those with access), and *NA* is a dummy taking value 1 for non-adopters (among those with access; respondents with no-access are always the omitted category). In words, our third research question is:

RQ3*: Assuming that the introduction of formal insurance is associated with reduced aggregate contributions to the common pot in a PG game, who is responsible for these lower contributions: adopters, non-adopters, or both?*

While it is easy to explain variation in common pool contributions by adoption status, it is likely that adoption status is correlated with other relevant variables driving contributions. In that case, correlations obtained in our regression framework might be spurious. As a robustness test we therefore do a slightly more elaborate analysis. We first explain adoption status (based on observations in access parishes only) and, based on the resulting regression coefficients of (1'), predict the probability of non-adoption for all households (including in the no access villages). This regression analysis enables us to compare public good contributions for (predicted) adopters and non-adopters across villages with and without access to insurance. We are interested in establishing whether predicted non-adopters without access behave similarly to predicted non-adopters with access. We estimate:

$$Pr(H_i=1 \mid Pr(n\text{-}a)) = \alpha + Pr(n\text{-}a)_i\beta + \varepsilon_i\,, \text{ and} \tag{6}$$

$$Pr(H_i=1 \mid Pr(n\text{-}a), I) = \alpha + Pr(n\text{-}a)_i\beta + I_i\ \gamma + (I_i)(\ Pr(n\text{-}a)_i)\delta + \varepsilon_i \tag{6'}$$

Where $0 \leq Pr(n\text{-}a) \leq 1$, is the predicted probability of non-adoption, and I x $Pr(n\text{-}a)$ is the model with interaction term between $Pr(n\text{-}a)$ and access to the insurance.

To complement the analysis we also estimate a propensity score matching (PSM) model, matching respondents from access and no-access areas. To probe whether contributions by predicted non-adopters are similar, or not, we then compare contributions of non-adopters, with credibly similar respondents in no access-areas, based on nearest neighbour matching.

RQ4*: Do predicted non-adopters with access to formal insurance behave the same as predicted non-adopters without access—is behaviour of non-adopters driven by population characteristics or by insurance?*

5. Empirical results

We first test the prediction that wealthier households are more likely to purchase formal health insurance than relatively poor households. Focusing on those parishes where insurance was offered, we explain variation in adoption across households. Results are reported in Table 2. Columns (1) and (2) illustrate a positive correlation between wealth and adoption. This relation may possibly be non-linear (column 1), but a linear relation ensues when we omit two outlier from the sample (see column 2). The finding that relatively wealthy households are more likely to adopt formal insurance is confirmed in columns (3) and (4), where we replace the wealth variables with a poverty dummy. We report probit marginal effects, so poor households are 20% less likely to adopt health insurance than non-poor households in access villages.[14]

[14] This finding is confirmed by abundant anecdotal evidence. Many respondents cite "financial problems" as the main reason for not purchasing the insurance. They claim that their income is too low in comparison to the fee, and would have joined the scheme "if only they had more money". Others state that they would join if there was a "reduction on the fee that SHU asks from them", or stress that they "joined but paid half of the money", and thus could not benefit from the insurance coverage.

Table 2: Wealth and the adoption of health insurance

Dependent Variable:	Insurance Adoption			
	Probit	Probit	Probit	Probit
	(1)	(2)	(3)	(4)
Wealth factor	0.146**	0.140**		
	(0.061)	(0.061)		
Wealth factor squared	-0.056**	-0.035		
	(0.023)	(0.030)		
Poverty dummy			-0.226***	-0.199**
			(0.082)	(0.095)
Additional Controls	no	no	no	yes
N	210	208	210	185
Correct predictions at P=0.5	63%	63%	62%	70%

Robust standard errors in parentheses; probit marginal effects. Wealth Factor based on vector of household level asset dummies. Model (2) removes the highest outlier from the sample. Probit marginal effects for Model (3); Poverty Dummy takes value of unity when household owns not more than one of the three most common assets (phone, radio, bicycle) and not more than one improved house feature (iron roof, brick wall, cement floor). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Additional controls include Age household head, Male household head, Education household head, Single, Household size, Female participant, Mothers in house, Watch TV weekly, Read newspaper weekly.

We next explain how the introduction or formal insurance affects play in the PG game. We first use the number of tokens shared as the dependent variable, and examine how this quantity varies with access status. Our access dummy captures whether or not a respondent's household resides in a village that has an active CHF scheme, regardless of its own adoption status. Results are reported in Table 3. Column (1) shows the results of the Heckman selection model, which controls for possible non-random attrition. Of 440 households interviewed, only 409 correct household representatives showed up for the afternoon (PG) game session. The other 31 participants were substituted by a random villager that was not a member of any of the interviewed households. While some observed characteristics affect the likelihood of showing up (i.e. if the household head is male, or if the randomly selected respondent is female), the coefficient on the inverse Mills ratio is statistically insignificant. In other words, there is no detectable self-selection bias into the experiment, and it is therefore safe to estimate the model using OLS and Probit. Respondents with access to the formal insurance share on average fewer tokens than their counterparts, consistent with findings by Klohn and Strupat (2013). Using a Poisson model yields similarly significant results (details

available on request).

In columns (2-4) we attempt to go further and identify who is responsible for the lower PG contributions—adopters or non-adopters. While one may expect that adopters will reduce their contribution to the PG—as they have less use for social capital in the future—our empirical results are different. Lower public good contributions are driven by relatively lower contributions of non-adopters. On average, non-adopters with access to the formal insurance contribute about 0.4 tokens less than respondents without access, or over ¼ of a standard deviation. In column (3) we cluster standard errors at the village level, which only slightly increases the standard errors. In column (4) we distinguish between households that have paid their premium (i.e. eligible to benefit from the insurance) and those that have only paid in part. Again, non-participants drive the reduction in contributions.

Table 3: Sharing in the public goods game

Dependent Variable:	Tokens Shared (S_i)				High Contributor (SH_i)		
	Heckman	OLS	OLS	OLS	Probit	Probit	Probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Insurance access	-0.307**				-0.093**		
	(0.148)				(0.045)		
Adopter		-0.188	-0.188			0.082	
		(0.170)	(0.185)			(0.057)	
Full payment				0.008			0.049
				(0.352)			(0.132)
Partial payment				-0.234			-0.112*
				(0.192)			(0.054)
Non-adopter		-0.402**	-0.402*	-0.402*		-0.101**	-0.101**
		(0.186)	(0.226)	(0.226)		(0.046)	(0.046)
Mills Lambda	-0.798						
	(0.819)						
Cluster Robust s.e.	no	no	44	44	44	44	44
N	440	409	409	409	409	409	409

Robust standard errors in parentheses; probit marginal effects in (5-7). Two-stage Heckman Selection Model is used in (1) to assess non-random attrition in the experimental sample. Excluded instruments in the selection stage include: Insurance adopter, Poverty dummy, Male household head, Education household head, Household size, Female participant, Watch TV weekly, Read newspaper weekly. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Similarly, when we try to explain the incidence of high contributions (i.e., the contribution of 4 or 5 tokens), the finding that there are fewer high contributors in access areas (column 5) is

driven by non-adopters (columns 6 and 7). They are 33% less likely to be high contributors, again representing about ¼ of a standard deviation.

Other factors may explain both adoption and contribution rates. Table 2, for instance, shows that non-adoption is primarily explained by wealth—poor households are significantly less likely to adopt insurance. If poorer households systematically contribute less to the common pot, the correlations in Table 3 may be spurious. To attenuate this concern we next use information about the propensity to be a non-adopter (based on the regression results in column (4) in Table 2). This enables us to compare "predicted non-adopters" in access areas to "predicted non-adopters" in no-access areas.

The results of the follow-up step are reported in Table 4. In column (1) we zoom in on access areas, and demonstrate that predicted non-adopters are less likely to share a high fraction of their tokens in the PG game. These results, of course, echo those in Table 3. However, when estimating the same model for the sub-sample of respondents with no-access, we find that the sign of the coefficient of interest changes–from negative to positive (column 2). Predicted non-adopters without access are *more* likely to contribute 4 or 5 tokens to the common pot. This may reflect the greater importance attached to social capital by relatively poor households. Upon pooling the data and including an interaction term (predicted non-adoption probability multiplied by insurance access), we can capture these results in one specification. According to results in columns (3) and (5), predicted non-adopters in no-access areas are more likely to contribute more to the common pot, but this is not true for predicted non-adopters living in parishes with an active formal insurance scheme—the interaction effect dominates the level effect of predicted non-adoption. Results in (3) are robust to clustering at the parish level (8) instead of the village level (44), using wild bootstrap inference to correct for the small number of clusters (Cameron et al., 2008).

As an alternative approach, in columns (4) and (6) we use Propensity Score Matching

to compare non-adopters to credibly similar counterparts in no-access areas, thus excluding the 106 adopters from the analysis. The average treatment effect obtained through nearest neighbour matching is consistent with previous findings. Matching is based on the same variables of column (2), Table 4. A logit model is used to calculate propensity scores. Balancing properties are satisfied for all matching variables, in each of the 5 blocks of equal score range. Also, the mean propensity score in each block is not different for non-adopters (in this setting, the 'treated') and no-access participants ('controls'). The predicted scores range between 0.044 and 0.688 for non-treated and between 0.045 and 0.602 for controls, so the common support region ranges between 0.045 and 0.602 (suggesting adequate overlap between groups). Restricting the analysis to the common support region (N=265, 70 treated and 195 controls) yields an ATT of -0.063 in (3), insignificant, and -0.349 in (6), significant at the 10% level. Kernel matching with bootstrapped standard errors yields similar results to Table 4.

Table 4: Predicted non-adoption and sharing in the public goods game

Dependent Variable:	High Contributor (SH_i)				Tokens Shared (S_i)	
	Access	No-access	Pooled	Pooled	Pooled	Pooled
	Probit	Probit	Probit	PSM	OLS	PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Pr(non-adoption)	-0.325*	0.309*	0.305*		0.691	
	(0.171)	(0.165)	(0.162)		(0.523)	
Insurance access			0.247**		0.424	
			(0.110)		(0.351)	
Insurance access x Pr(n-a)			-0.635***		-1.258*	
			(0.235)		(0.678)	
Non-adopter with access				-0.105*		-0.402**
				(0.058)		(0.186)
Cluster Robust s.e.	21	23	44	no	44	no
N	185	184	369	303	369	303

Cluster robust standard errors in parentheses; probit marginal effects in (1-3). Average treatment effect on the treated (ATT) using nearest neighbor matching with random draw. The propensity score in (4) and (6) is calculated on: Poverty dummy, Age household head, Male household head, Education household head, Single, Household size, Female participant, Mothers in house, Watch TV weekly, Read newspaper weekly (see Table 2, column 4); the same variables are used to predict Non-adoption in columns (1-3) and (5). Clustering at the Parish level in (3), and correcting for the small number of clusters following Cameron et al. (2008), yields a P-value of 0.020 for the interaction term, significant at the 5% level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We interpret these findings as tentative evidence that the results in Table 3 are not driven by

spurious correlation. Non-adopters do not contribute less in public good games because they are poor, but because of the interaction between poverty and formal insurance availability. This is fully consistent with the perspective on insurance-related arrangements embedded in a broader social structure. Those villagers left behind after the relatively wealthy have adopted insurance signal their discontent by foregoing cooperation in other domains of social interaction.

6. Discussion and conclusions

Social capital is a key determinant of the ability of communities to overcome social dilemmas, and fostering social capital has become a policy goal in and of itself. For example, Fearon et al. (2010) demonstrate that outside innovations may facilitate investments in social capital. However, not all interventions have such benign effects. Specifically, interventions which benefit a subsample of the population may weaken mutual dependencies and erode social capital. Our study provides evidence to support the latter—our data are consistent with a broad perspective on social interactions, where reduced inter-dependencies in one domain (informal insurance) invite behavioural changes in other domains (public good contributions).

Formal insurance provides a substitute for informal insurance, crowding out social capital. Anecdotally, we find evidence of such dynamics in our open-ended questionnaire. Respondents lament that, since the introduction of the formal insurance, some of the informal risk sharing mechanisms have deteriorated. A non-adopter states that, in contrast to insurance holders, when she fell sick she had to "totally cater for herself." Another respondent claims that someone "had joined SHU, and therefore refused to help a neighbour who had a sick son." In the words of other respondents, the insurance scheme "spoils care for those who can't pay for the scheme," and "if you are not a member you are not catered for." But the deterioration of mutual assistance works both ways. Various respondents emphasize that (non-adopting) neighbours refuse to take insurance holders to the hospital (even if transport

costs are typically not part of the insurance package). Another respondent mentions the case of a pregnant woman whom "people refused to help, because she is in the insurance." Apparently the non-adopters are not passively undergoing their plight—they take action and signal their discontent by ceasing cooperation in other domains, in an effort to "discipline" adopters.

Indeed, one important new finding of our study is that the erosion of social capital is not primarily caused by adopting community members – those respondents who may opt out of the insurance network. Instead, the deterioration of social capital in our field experiments is fully explained by a behavioural response of non-adopters.

In light of the widely-recognised importance of social capital (and informal institutions more generally) as a determinant of economic outcomes, we speculate that a "weapons of the weak perspective" on outside interventions may be relevant. Indeed, there may be cases where welfare analysis (based on CGE models or otherwise) should be augmented to explicitly consider social embeddedness—private cost-benefit ratios associated with specific innovations may fail to accurately predict patterns of adoption. Similarly, policy makers should not underestimate the power of the weapons of the weak in shaping policy outcomes—welfare externalities might be far reaching and tough to predict.

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Appendix I—Detailed Variables Definition

Female participant: takes value of 1 if selected game participant is female, zero otherwise

Single: marital status household head single = 1, zero otherwise

Married/Engaged: marital status household head married or engaged = 1, zero otherwise

Widowed: marital status household head widowed = 1, zero otherwise

Age household head: age class of the household head, in 20-year blocks from adulthood (18)

Male household head: takes value 1 if household head is male, zero otherwise

Education household head: takes value 1 if household head has completed primary school

Household size: number of people that usually eat at least one daily meal together with the household head, acknowledging its authority and living with the rest of the household

Mothers in house: takes value of 1 if the household comprises at least one pregnant woman or mother taking care of a child at present time, zero otherwise

Watch TV weekly: takes value of 1 if the household head declares to watch TV at least once a week, zero otherwise

Read newspaper weekly: takes value of 1 if the household head declares to read the newspaper at least once a week, zero otherwise

Radio: takes value of 1 if the household possesses any type of radio, zero otherwise

Phone: takes value of 1 if the household possesses any type of phone, zero otherwise

Bicycle: takes value of 1 if the household possesses any type of bicycle, zero otherwise

Motorbike: takes value of 1 if the household possesses any type of motorbike, zero otherwise

Television: takes value of 1 if the household possesses any type of television, zero otherwise

Car: takes value of 1 if the household possesses any type of car, zero otherwise

Generator: takes value of 1 if the household possesses any type of electricity generator, zero otherwise

Wealth factor: a principal factor obtained by factor analysis following Sahn and Stifel (2003), from the abovementioned asset list (radio to generator) possessed by the household

House features index: is the sum of three dummy variables representing improved house features, i.e. iron roof, brick wall, cement floor

Common assets index: is the sum of three dummy variables representing the three most common assets, i.e. radio, phone and bicycle

Poverty dummy: takes value of 1 if the household scores 1 or less in the House Features Index and scores 1 or less in the Common assets index, zero otherwise

Adopter: takes value 1 if a household is residing in a parish (village) with an active and running CHF insurance scheme, and adopted the insurance; zero otherwise

Non-adopter: takes value 1 if a household is residing in a parish (village) with an active and running CHF insurance scheme, and knowingly renounced participation; zero otherwise

Full payment: takes value of 1 if a household that adopted the CHF insurance scheme has fully paid the due premium, zero otherwise

Partial payment: takes value of 1 if a household that adopted the CHF insurance scheme has only partially paid the due premium, zero otherwise

Insurance access: The sum of Adopter and Non-adopter. It takes value 1 if the household has access to the formal insurance, regardless of its adoption status; zero otherwise

S: is the number of tokens contributed to the common pot of the public goods game by a given participant, minimum is 0 and maximum is 5

SH: takes value 1 if the participant has contributed 4 or 5 tokens to the common pot of the PG game—i.e. one standard deviation or more above the average –, zero otherwise

Non-adoption probability Pr(n-a): the probability of adoption as predicted for respondents from access areas, based on the individual and household level socio-economic characteristics of column (4), Table 2