Can Trust in Health Insurance Reduce Poverty? Evidence from a Low-Cost Trust-Building Intervention

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Health insurance may engage people in higher-health-risk higher-return activities, thus increasing incomes and decreasing poverty, but only if people trust the product. To build trust, we randomly 1) offered one-year subsidies to some, 2) invited others to meetings together with their existing informal groups of close friends about the product. Despite giving no financial incentives to those friends who already received a payout to speak about the promise of health insurance, we find that only this intervention, not short-run subsidies, builds trust in the product. Two years later, this intervention increased the purchase of health insurance, and engaged people in higher-health-risk higher-return activities: farmers grew more crops using pesticides and more cattle. Overall, incomes increased by 22 percent, essentially placing people above the poverty line. These results are important considering the very low cost, thus the scalability, of organizing such meetings in existing informal groups.
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In the absence of health insurance, people may choose low-health-risk low-return activities. Examples of high-health-risk high-return activities (identified as such by our respondents who are small-scale farmers in Kenya) include using pesticides[1] or growing cattle.[2] This is an important claim, because it creates the conditions for a poverty trap: poor people typically without health insurance will shy away from these high-return activities, which perpetuates the vicious circle of poverty. Considering the wide applicability of health insurance not just to farmers but also to most activities in developing countries[3], it is critical to evaluate whether health insurance truly engages people in higher-health-risk higher-return activities, with the positive side effect of breaking a poverty trap, but the potential negative side effect of damaging people's health (i.e., moral hazard).

This paper is the first to study these effects. An extensive literature on health

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[1] In Sub-Saharan Africa, pesticides can be extremely hazardous, improperly labelled, unsafely used, and cause respiratory accidents and deaths (Gomes et al. 2002). There is also considerable evidence that pesticides compared to organic farming significantly increase yields, and improve food security (Valkila 2009, Enserink et al. 2013). Considering the absence of local organic markets for food crops in developing countries, and underdeveloped organic markets for cash crops (for example, only 1 percent of all coffee sold worldwide is organic (Valkila 2009)), using pesticide is a high-return activity, and reduces poverty (Valkila 2009, Stokstad and Grullon 2013).

[2] Growing cattle is a dangerous but highly profitable venture (Dercon 1998).

[3] For example, in urban areas, 3 millions workers in Kenya work as metal workers in "Jua Kalis", an extremely dangerous but also highly profitable work environment Chemin et al. (2015).

insurance has traditionally focused on health expenditures, healthcare access and health (Thornton et al. (2010), King et al. (2009), Asuming (2013), see Acharya et al. (2012) for a survey of 34 experimental and non-experimental studies), with overall little evidence on the impact of health insurance on health (Acharya et al. (2012), p.8). Exploring engagement in higher-health-risk higher-return activities is important before discarding health insurance as a policy tool to fight poverty. A rigorous literature on weather insurance has recently shown that people offered weather insurance for free engage more in crops that are more sensitive to rainfall and also more profitable (Karlan et al. 2014, Cole, Giné and Vickery 2013, Mobarak and Rosenzweig 2012). It is much less clear whether health insurance would have the same positive effects: health risks are idiosyncratic, thus are insurable by local informal insurance networks (as opposed to weather shocks that usually affect the whole community); the health risks mentioned (spraying pesticides, growing cattle) can be entirely avoided by hiring other people to take them on (not possible with weather risks); poor people might already be taking maximum health risks to sustain their families (in contrast, there is considerable evidence that the poor undertake safe income-generating activities in the absence of income insurance (Morduch 1995)). For these reasons, health insurance (as opposed to weather insurance) might make no difference in the lives of farmers, and not engage them in higher-health-risk higher-return activities.

Moreover, the literature on weather insurance casts doubts on the appropriateness of short-run subsidies for products paying out very infrequently, such as in-patient health insurance,[4] in a developing country context characterized by very low trust in insurance products (Cole, Giné, Tobacman, Townsend, Topalova and Vickery 2013, Dercon et al. 2011, Cai, Chen, Fang and Zhou 2015). Karlan et al. (2014) find that the (few) people not experiencing a weather insurance payout dropped the product after the subsidy had been discontinued. This suggests that after short-run subsidies on in-patient health insurance, most people would not experience a payout, not build trust, not engage in higher-risk higher-return activities, and drop the product once the subsidies are over, making subsidies a waste of scarce resources. This is unfortunate since insurance offers its largest benefit for low-probability high-loss events (Karlan et al. 2014). For such products, Karlan et al. (2014) call for trust-building mechanisms rather than subsidies.

The main contribution of our paper is to evaluate the effects of an innovative experimental design without any subsidies, instead aimed at building trust, on trust, purchase of insurance, and engagement in high-risk high-return activities two years later, in comparison to short-run subsidies, on a representative sample of 4,805 individuals living in 1,386 households in rural Kenya. The intuition for our intervention goes as follows. The particular in-patient health insurance product was created in 1966. Even though payouts are rare, there might be someone in one's circle of friends who has experienced a payout, and can thus speak to the promise of health insurance, if that circle is large enough. This,

[4]In our sample, only 8 percent of the households per year had one of their members hospitalized.

rather than subsidies, may build trust, encourage the purchase of health insurance, and engage people in high-risk high-return activities. In practice, we randomly selected 186 households, and asked them to identify their most important informal group (most respondents belonged to informal groups, a pervasive phenomenon in developing countries, offering social support, credit and savings opportunities, with an average size of 62 group members in our sample). We then delivered information about the product in an "informal group meeting", to encourage a discussion where individuals who have already experienced the product could share their experience, without any financial incentives to do so (to avoid the negative effect of peer referral incentives found in Dercon et al. (2011)). Of course, this might not work if discussions about the health insurance product were occurring before our meetings. In the same geographical area, 283 households formed a control group that were not invited, but could have benefited from attending these meetings.

We compare this intervention to short-run subsidies. In another geographical area to avoid any contamination issue, we offered one-year subsidies and information about the product to a random sample of 169 households, just information to 389 households. A control group of 359 households received no interventions.

We find that two years after a one-year subsidy (an offer taken up by only 40 percent of our sample, which already indicates a severe reluctance to the product) or after receiving information, none of the respondents decided to purchase the product at full cost. For these individuals, we find that trust in the product did not increase. We witness no change in the risk portfolio of farmers. This casts doubts on the ability of temporary subsidies to break poverty traps, in contrast with the positive results found in the literature on weather insurance.

In contrast, after being invited to an informal group meeting, 10 percent of individuals purchased health insurance, 6 percent still had it two years later, a remarkably large number given the absence of any subsidies and the low cost of organizing an informal group meeting (0.7 USD per person versus subsidies of 25 USD per person for the product). Trust in the product increased by 0.15 standard deviation. We witness a considerable change in risk portfolios. We find that the probability to use pesticides increased by 17 percentage points, and the probability to grow cattle by 10 percentage points, over a 2-year period in the treated versus control group. Income from cattle and crops using pesticides increased by 40 percent. Overall, total income increased by 22 percent, which represents a sizable increase for people living at the poverty line of 2 USD per day per capita. This points to the large hidden costs of insurance in terms of the choice of low-health-risk low-return activities.

Importantly, these activities did not cause significantly more work accidents, hospitalizations, or days of work lost due to health reasons. In fact, we find that people took more precautions in the face of these greater risks. Moreover, we do not find that formal insurance crowds out informal insurance. In the treatment group where some took up, people do not report abandoning their

informal group. In fact, people report receiving more informal health insurance in case of hospitalization. Insured members thus have positive spillover effects on the uninsured through informal insurance, which might explain why the effect on pesticides is even higher then the effect on take-up (17 versus 10).

The difference cannot be explained by extra knowledge gained in the meetings. Knowledge about the product increased after an informal group meeting, but by the same amount as after receiving a temporary subsidy. Moreover, delivering information alone had no effect on trust, take-up or engagement in higher risk higher return activities. Meetings in these existing informal groups is critical to affect behavior, potentially because it is the only intervention that increases trust in the product.

These results are important because they suggest a fiscally feasible way to break poverty traps. Considering the low costs of organizing group meetings versus giving subsidies, the fact that they increase (even by a small amount) purchase of the product, risk-taking behavior, and incomes, is thus an important policy lesson. Our results suggest that health insurance may be a much more important tool in the fight against poverty than previously thought (Acharya et al. 2012).

This paper also contributes to a recent literature on short-run subsidies and long-run adoption of health products. Dupas (2013) finds that short-run subsidies increase long-run adoption of bed nets, while a higher density of neighbors with bed nets reduces long-run adoption.[5] Health insurance is very different from bed nets. It may take a much longer time to build trust in health insurance considering the trigger (hospitalization) is such a rare event. This may explain why we find no effect of short-run subsidies on long-run adoption. This may also explain why we find more encouraging results with social networks: neighbors with the product have had time to experience the product, and can speak to the promise of health insurance. This shows that results of the same interventions depend largely on the nature of the good provided, and the need to build trust.

This paper is organized in the following way: Section 1 provides background information on high-health-risk high-return activities and the insurance product, and clarifies our theoretical predictions. Section 2 details our experimental design. Section 3 presents the data, Section 4 the methodology, and Section 5 the results. Section 6 concludes.

I. Background and conceptual framework

This project is implemented in the rural community of Kianyaga, Kirinyaga county, Kenya, among a sample of 4,805 individuals living in 1,386 households. The household heads are mostly farmers (M=0.95, SD=0.22), working on small plots (M=1.7 acres, SD=23.3), living at the poverty line (M=4,808 Ksh per month per capita $\simeq$2 USD per day per capita, SD=8,781). This sample is representative of the rural areas of Central Province of Kenya, an area comprised of almost

[5]Possibly explained by a lower malaria transmission rate from neighbors, thus less need for bed nets.

three million people (see Table A1 for representativeness of sample). Our respondents grow crops (such as coffee, tea, maize beans), rear livestock (such as cattle, chicken), and use inputs (fertilizer, pesticide). We asked farmers from this community what the high-health-risk high-return activities were.

A. High-health-risk high-return activities

Pesticide

The most frequently cited activity is using pesticide: "Spraying pesticides is dangerous because they can burn someone or you can inhale them without knowing"; "Allergic reactions to the pesticides made me stop doing it" (quotes from open-ended qualitative interviews in brackets). In Sub-Saharan Africa, and in Kenya in particular, pesticides are highly hazardous, improperly labeled and used (Ohayo-Mitoko et al. 2000). This results in respiratory difficulty, unconsciousness, pulmonary edema and death due to respiratory arrest (Alavanja et al. 2004, Gomes et al. 2002). Developing countries use only 20 percent of the world's agrochemicals, yet they suffer 99 percent of deaths from pesticide poisoning (De Silva et al. 2006). More toxic chemicals are still used, and basic safety equipment is often lacking (Stokstad and Grullon 2013). The World Health Organization estimates that 3 million severe pesticide poisoning episodes occur annually, and of these, a minimum of 300,000 people die in developing countries (WHO 2003).

The returns to using pesticides are high. Diverse and rapidly evolving pathogens cause plant diseases and epidemics that threaten crop yield and food security around the world (Dangl et al. 2013). There is considerable evidence that pesticides significantly increase yields and improve food security (Valkila 2009, Enserink et al. 2013). For the example of coffee, the main cash crop in the community studied, yields are twice as much on conventional versus organic farms (Valkila 2009). The organic price premium was only 7 percent in 2009, which may explain why only 1 percent of all coffee sold worldwide is organic (Valkila 2009). For other food crops consumed locally (maize, beans, etc.), there are no local organic markets in developing countries (Valkila 2009). The low organic price premiums, or complete absence of these markets, makes pesticide still a high-return activity in developing countries.[6]

Not all crops need pesticides. In our qualitative interviews, farmers indicate that they spray pesticide on coffee[7], passion fruit, mango, papaya, tomatoes,

[6]On an environmental level, unlike fertilizers, pesticides do not contribute to greenhouse gas emissions, but can kill untargeted insects, rodents, fish, birds, and pollute water (Dangl et al. 2013). This can be avoided by establishing water buffer zones, as recommended by fairtrade certifications (PANUK 2008). In any case, the costs of these negative externalities are not borne by pesticide users, and thus not part of the decision process to use them. One way to internalize these externalities is by rewarding farmers using no pesticides with a higher price, i.e., organic farming. Unfortunately, as explained above, organic markets are still underdeveloped in developing countries, and organic price premiums on export crops are low. Still, a disutility for these environmental costs may drive farmers to always prefer low-risk low-return activities, which would make health insurance irrelevant. We fully account for this possibility in our theoretical model.

[7]More than 900 pests affect coffee (coffee leaf rust, coffee berry disease, coffee stem borers, etc.)

spinach, onions, carrots, green peppers, pilipili, french beans. They do not spray pesticides on tea, bananas, spinach, cabbage, beans, sweet potatoes, maize, sugar cane, pumpkins. We thus define the first group as crops using pesticides, and the second group as crops not using pesticide.[8]

Cattle

Other farmers answered rearing cattle: "Feeding cows is dangerous because of attacks, they do hurt someone and at times that can kill"; "I got knocked by a cow when securing it". In parallel to these risks, the returns to cattle are massive. In qualitative interviews, farmers from this area report that a 5 months bull is worth 8,000 to 10,000 Ksh, while a 3 year bull is worth 60,000 to 100,000 Ksh. Dercon (1998) find that differences in total incomes between richer and poorer terciles can be traced to differences in cattle ownership across households. Some households are able to accumulate substantial cattle herds and the return on this investment provides permanently higher incomes and consumption. Dercon (1998) estimates that the returns to cattle are about 23% per year, consistent with FAO estimates.

Trees

Farmers report that growing macadamia nuts and avocados is risky because of the possibility of falling from the trees when collecting them, or items falling from trees: "One may fall off from macadamia trees and break a limb" "Cutting, pruning, or weeding trees can be dangerous due to falling items, which can make someone break a part of their body, or experiencing cuts". The returns to these crops have also been estimated to be large (Gitonga et al. 2009).

Risk portfolio

These discussions allow us to build a portfolio of risky activities. We define $AgIncomeRisky_i$ as agricultural income per month per capita from crops using pesticide, cattle, macadamia, avocado.[9] Similarly, we define $IncomeNotRisky_i$ as income from other crops, other livestock (goats, sheep, chicken, pigs, geese,

and can obliterate crops if not addressed. The biggest current problem is coffee leaf rust, a fungus which destroys green leaves, impedes photosynthesis, destroys crops (up to 70 percent if not addressed) (KAPAP 2009). The only know treatment is to use a fungicide (resistant coffee plants produce low quality coffee, such as Riuru 11 in Kenya, KAPAP 2009). The organic fungicide (copper sulfate) is much less efficient than synthetic fungicide, and can build up in soils and kill fish. Recognizing this issue, the main fair-trade certifications do not ban the use of pesticide, even highly hazardous ones (classified WHO1). Instead, they recommend 1) safe use of these pesticides, 2) training, 3) first aid kits availability, 4) personal protective gear, and 5) environmentally safe practices (water buffer zones) (PANUK 2008).

[8]The other main input to crop yields, fertilizer, is considered by farmers in this area much safer to use than pesticides. The adverse health effects, such as cancer, through pollution of the ground water have been well documented (Ward 2009), however these effects are less direct to the farmers than with pesticides. Unlike pesticide, the application of fertilizer may not result in hospitalization, the trigger of the health insurance product considered in this paper.

[9]Multiplying quantity of the crop sold at market, sold to broker, or consumed at home by median price of each crop sold at market.

ducks, and rabbits), and formal sector work (2.3 percent of our sample report working in the formal sector, 32 percent of which are teachers). So as to avoid data mining issues, we specify these two measures in a pre-analysis plan.[10][11] This risk portfolio may be affected by health insurance, which we describe in greater detail below.

B. Health insurance

The claim of this paper is that health insurance may shape the activities chosen by farmers. The health insurance product studied in this paper is an in-patient product (that pays out only on admission for at least one night in a hospital) from the National Hospital Insurance fund (NHIF). It costs 1,920 Ksh per year (∼25 USD, 2 percent of average yearly household consumption). It is actuarially fair, in the sense that the insurance premium is less than expected rate of hospitalization (8 percent in this sample) multiplied by the average costs of hospitalization. A large public hospital is available one hour by car from this community. Healthcare is not free for the poor in Kenya. Instead, hospitals usually detain people in guarded wards until they can pay (Sood et al. 2007, Owino and Were 1999).

Despite the benefits provided by this product, a key concern for take-up is lack of trust, as identified by microinsurance practitioners (Brown and Churchill 2000). The authors argue that the level of uncertainty is higher with insurance than with other financial products such as savings or credit. With savings, the customer is unsure whether the institution will safeguard their deposits, but the customer may test the relationship at any time by withdrawing funds. With credit, the roles are reversed since it is the lending institution which is unsure whether the borrower will repay the loan. By contrast, with insurance, the client will not know whether the insurer will keep its promise until some uncertain time in the future when the policyholder makes a claim, and this relationship cannot be tested until this time (Brown and Churchill 2000). Issues of trust may be exacerbated for in-patient health insurance that pays out very infrequently. This may explain why take-up is so low (10 percent) in the informal sector where the product is on a voluntary basis.

A growing academic literature also identifies trust as a key concern for in-

[10] RCT ID AEARCTR-0000705

[11] We then verify whether these measures are correlated or not with measures of risk. First, we define $NumberRisks_i$ as the count of risks in the question "Please list the three main risks you face in your work / daily duties environment" (Mean=2, SD=1.3). Potential risks are: Exposure to weather, Burns / Explosions, Traffic Accidents, Cuts/pricks, Falling Items, Inhaling Chemicals, Other Air Pollution, Electric Shocks, Infectious Diseases, Poor Sanitation / Sewerage / Hygiene, Violence / Crime, Social Troubles, Exhaustion, Fatigue, Unclean Food, Overcrowding, Congestion, Noise, Body Aches, Falling, Dangerous Animals (e.g.. snakes, spiders). In results not reported, we find that $AgIncomeRisky_i$ is positively correlated with the number of risks faced, while $IncomeNotRisky_i$ is not. Second, we define $RiskPesticide_i$ as a dichotomous variable equal to 1 if the individual mentions inhaling chemicals or burns, direct consequences of pesticide use, as one of the three main risks faced in the work environment, 0 otherwise. Twenty percent of the sample reports facing such risks (SD=0.4). In resulst not reported, we find that $AgIncomeRisky_i$ is positively correlated with such risks, while $IncomeNotRisky_i$ is not. These correlations validate our construction of these two portfolio of activities as risky versus less risky.

surance products in developing countries. Cole, Giné, Tobacman, Townsend, Topalova and Vickery (2013) find that demand for weather insurance increases by 10 percentage points when the educator is first recommended to the household by a trusted local agent. This indicates that trust is an issue, otherwise the recommendation would have no effect. They also find that demand for weather insurance is higher in villages that previously experienced a payout. Dercon et al. (2011) finds that measures of trust are positively associated with health insurance demand. Cai, Chen, Fang and Zhou (2015) finds that farmers who trust other government programs are also more likely to take up government livestock insurance.

This literature also finds that trust can be extremely difficult to build. In Cole, Giné, Tobacman, Townsend, Topalova and Vickery (2013), take-up *decreases* by 7 percentage points if the household had no previous interactions with an endorser. In Dercon et al. (2011), a peer referral incentive, whereby any individual received an incentive for each member brought to sign the policy, *decreased* take-up by 7 percentage points.

To sum up, farmers can choose between safe and risky activities, that may return more. To mitigate these risks, they can purchase health insurance, which they trust more or less. In our conceptual framework below, we clarify the predictions that will be tested in the data.

C. Conceptual framework

In a simple model where farmers face the choice between safe and risky activities that return more, where hospital costs are paid by health insurance, and where disutility from negative externalities associated with the risky activity, such as environmental degradation, is incurred, it is possible to show (see model in Appendix B for details) that:

PROPOSITION 1: *Subsidized insurance may increase risk-taking behavior, income, and welfare.*

However, if people do not believe that health insurance will pay for their hospital costs, health insurance, even provided for free, will not affect behavior. Thus (see model in Appendix B for details):

PROPOSITION 2: *An exogenous increase in the probability of repayment, even coupled with high insurance premiums (unsubsidized but credible insurance), may increase risk-taking behavior, income, and welfare.*

Of course, these propositions would not hold if informal insurance networks already cover for these risks, if farmers hire others to take on these risks, if poor people already take maximum health risks even in the absence of health insurance, or if farmers have a strong disutility from falling sick or from negative externalities such as environmental degradation, caused by these activities.

In the next section, we present our experiment designed to test these propositions, and in particular explain how we proceed to generate an exogenous increase in the perceived probability of repayment, i.e., trust in the product.

II. Experimental design

A. Short-run subsidies

In Area 1, we randomly selected 169 households to receive free (or 90 percent subsidy) health insurance for one year. For each of these 169 households, in the privacy of their homes, we 1) delivered and presented an NHIF brochure containing all relevant information about the product, 2) explained the very basic concept of insurance with a cartoon, 3) offered assistance to register (filling the form and sending it on their behalf to NHIF). Note that participants still had to visit our office with the proper documents (national identification card for all adults and birth certificate for all children) for us to organize the rest of the registration.

To verify whether the effect is driven by the short-run subsidy or the information delivered, we randomly selected 389 households to receive the same information and assistance to register.[12] Finally, 359 households received no interventions, and formed a control group.

B. Informal group meetings

The intuition of our intervention is that close friends who have themselves experienced a reimbursement by NHIF are best placed to reinforce trust in NHIF. As one of our respondents put it: "I have no previous experience with insurance, but I have a friend who has NHIF. When that man's wife fell ill, NHIF paid the bill in full. Therefore, I trust the company". To find these close and respected friends, we used existing social networks in the following way. In Area 2, a different geographical area separated from Area 1 by more than 2 hours by foot without roads, we randomly selected 186 households. We asked them to identify the most important social group that they belong to (e.g., ROSCAs, clan or family groups, church groups). Upon approval by the chairperson (obtained in 92 percent of the cases), we then organized a presentation at the usual meeting time and place of the group. To the general audience of the group meeting, we offered the same information and assistance to register as in the subsidy intervention. No subsidies were offered. We did not incentivize early adopters to talk. This intervention

[12] To be more precise, a variety of interventions were implemented in this group (endorsement by community leaders, lower more frequent payments, electronic payments). However, none of these treatments turned out to be successful at raising take-up. We thus lump them together, as we expect no impact of these interventions on trust and engagement in higher-risk higher-return activities considering the absence of any take-up. The common denominator to this group was the brochure, cartoon, and assistance to register.

merely provides an environment in which to share a positive experience about NHIF.[13][14]

In this same geographical area, 283 households formed a control group. Despite them not being invited to a meeting, they could still attend the meetings if they belong to the same informal groups as our participants. This group thus measures the potential spillovers inherent in organizing group meetings. We call this group the "Control Group Spillover"

III. Data

A baseline survey was collected in 2010/2011, and an endline survey in 2013/2014, to measure the effects of these interventions on trust, purchase, and engagement in high-risk high-return activities two years later. We tracked our baseline respondents through cellphones, plot numbers on official maps, maps drawn on our surveys, and asking neighbors. Overall, attrition between the endline and baseline surveys was kept low at 8.8 percent. A later section shows econometric corrections for this attrition.

A. Descriptive statistics

Table 1 shows the basic socio-economic characteristics of our sample. In the control group of Area 1, the household heads are on average 46 years old (Column (1)), have 8 years of education (corresponding to a primary school education, Column (2)), mostly male (73 percent, Column (3)).

In Column (4), risk aversion is measured by the number of safe choices in a series of 11 choices between more or less safe lotteries.[15] Our respondents are slightly risk-averse since they choose safe lotteries more than half the time (51 percent).

Patience could affect health insurance take-up, and investment in agricultural inputs. If people highly discount the future, they might invest less in new technologies. In Column (5), time preferences are measured by the number of distant

[13]In qualitative debriefings from group meetings, we found that the early adopters present in each group stand up and talk about their positive experience, despite having no incentives to do so. No negative experience are reported.

[14]Our intervention is different from recent experiments on weather insurance and social networks undertaken in Cai, De Janvry and Sadoulet (2015), Gine et al. (2013), Dercon et al. (2014). These three papers find that giving information about weather insurance to some farmers increases knowledge and purchase by some targeted farmers (in a first stage), which spills over to their friends (in a second stage). This design would not have been possible in our case, since we later find that delivering information does not raise take-up in the first stage, and is thus unlikely to spill over in a second stage. Instead, we use social networks in a different way. Rather than delivering information to some targeted farmers of the social network, we deliver information to a targeted farmer *together* with his whole informal group. The intuition is that, if the group is large enough, there might be someone in this group who has already experienced a payout since 1966, and can speak to the promise of insurance.

[15]The first choice was between a 100 KSH for sure (safe), or equal chances to get 100 KSH or 200 KSH (risky). In subsequent choices, the safe amount is increased by 10 Ksh from 100 Ksh to 200 Ksh. In the end, a random number between 1 and 11 is drawn, and actual payments were given to the respondent according to the choice made. An individual choosing a higher number of safe amounts is deemed more risk-averse than others.

Table 1—Descriptive statistics and balance of observable characteristics

	(1) Age	(2) Education	(3) Female	(4) Risk-Av.	(5) Time pref.	(6) Religiosity
Mean control group	45.96	7.88	0.18	0.51	0.66	2.34
SD control group	13.97	4.01	0.38	0.39	0.31	2.05
Informal Group Meeting	1.89	-0.76**	0.03	-0.03	0.04	0.37*
	(1.26)	(0.36)	(0.03)	(0.03)	(0.03)	(0.22)
Subsidy	-0.78	-0.06	-0.03	-0.02	0.01	-0.07
	(1.37)	(0.38)	(0.03)	(0.03)	(0.03)	(0.39)
Control Group Spillover	1.78	-0.50	-0.02	0.01	0.00	0.54***
	(1.21)	(0.32)	(0.03)	(0.03)	(0.02)	(0.18)
Information	0.54	-0.56*	-0.01	-0.01	0.05**	-0.08
	(1.03)	(0.29)	(0.03)	(0.03)	(0.02)	(0.16)
Observations	1,318	1,258	1,368	1,348	1,358	971
P-val Group vs Subsidy	0.09	0.12	0.18	0.78	0.38	0.30

Note: OLS regressions. Robust standard errors in parentheses, clustered at the location level. *** p<0.01, ** p<0.05, * p<0.1. The first two rows show the mean and standard deviation of age, education, gender, risk-aversion (measured by answers to choices between safe and risky lotteries), time preferences (measured by answers to choices between immediate and distant payoffs), and religiosity (measured by a question on deciding its own destiny vs God's plan) of household heads in the control group. The next rows show the coefficient of a regression of the variable considered on four dichotomous variables for the four groups created by the experimental design: people invited to an "Informal Group Meeting", people eligible for a subsidy, people not invited to the meetings but living close to those invited, i.e., in the "Control Group Spillover", and people receiving "Information" about the insurance product. The omitted category is those being in the control group in Area 1. The final row presents the p-value from a t-test comparing the coefficients of "Informal Group Meeting" versus "Subsidy".

choices in a series of 21 choices between lower amounts in a near future versus higher amounts in a more distant future.[16] On average, people choose 66 percent of their answers in the future.

In Column (6), we measure religiosity with answers to the following question: "Some people believe that individuals can decide their own destiny (individual's plan), while others think that it is impossible to escape a predetermined fate (God's plan). Please tell me which comes closest to your view on this scale: 1 means everything is determined by fate (God's plan), and 10 means people shape their own destiny (individual's plan)?". Overall, people strongly answer in favor of God's plan (Mean=2.3, SD=2). If people believe disease, and even time of death, are predetermined, then no extra risk or risk-coping behavior will affect

[16]The first choice was between KSH 20 tomorrow, or KSH 150 one week from now. In subsequent choices, the safe amount is increased by 20 Ksh from 20 Ksh to 140 Ksh. The next series of questions was between the same amounts tomorrow versus 2 weeks. The last series of questions was between the same amounts in one week versus in two weeks. In the end, a random number between 1 and 21 is drawn, and actual payments were given to the respondent according to the choice made. An individual choosing a higher number of amounts in the distant future is deemed more patient than others.

this. People might thus live the same lives with or without health insurance. This essentially stacks the decks against finding an effect of health insurance.

B. Balance of observable characteristics

We report in the rest of Table 1 the difference in the average of these variables between the control group and the four groups of interest: people invited to an "Informal Group Meeting", people eligible for a subsidy, people not invited to the meetings but living close to those invited, i.e., the "Control Group Spillover" of Area 2, and people receiving only "Information" about the insurance product. In practice, we run a regression of each variable of Table 1 on these four dichotomous variables. The omitted category is those being in the control group of Area 1.

The basic socio-economic characteristics of our respondents are balanced across the four treatment groups. Column (1) of Table 1 shows that household heads are slightly older (by 1.9 years) in the "Informal Group Meeting" intervention. As age is usually negatively correlated with risk-taking behavior, this could bias negatively our results on risk-taking behavior in the "Informal Group Meeting". However, this difference is not statistically significant. In fact, none of the treatment groups (subsidy, information, control group spillovers) show significant differences. Column (2) shows that household heads are slightly less educated in the "Informal Group Meeting" intervention. If education is positively correlated with health insurance take-up and income, this should again bias negatively our results. Columns (3), (4), and (5) show no significant differences across treatment groups in the gender, risk-aversion, or time preferences of the household head. Column (6) shows that people answer slightly more (by 0.37 points out of 10) in favor of the individual's plan in the "Informal Group Meeting" intervention. Less religious people might purchase more health insurance, but take less risks, if they do not believe their fate is predetermined, whch would again bias the results negatively. In any case, we control in all subsequent regressions for these factors.

IV. Methodology

To measure whether being invited to an "Informal group meeting" affects trust in insurance, purchase, and risk-taking behavior, we use the following regression:

$$\begin{aligned} y_i &= \alpha_0 + \alpha_1 InformalGroupMeeting_i + \alpha_2 Subsidy_i \\ &\quad + \alpha_3 ControlGroupSpillover_i + \alpha_4 Information_i \\ &\quad + \beta y_{i0} + X_i'\gamma + \epsilon_i \end{aligned}$$

where i corresponds to household i. The dependent variables y_i are trust in insurance, purchase of insurance, engagement in higher-risk higher return activities, income, health, health care access, and informal insurance. We focus on intent-to-treat estimates. $InformalGroupMeeting_i$ is a dichotomous variable equal to

1 if individual i was randomly invited to an informal group meeting, 0 otherwise. $Subsidy_i$, $ControlGroupSpillover_i$, and $Information_i$ are defined similarly.

Following McKenzie (2012), we condition on the baseline level of the outcome variable when available, y_{i0}, to improve statistical power. X_i are the control variables of Table 1 (age, education, gender, risk-aversion, time preferences, and religiosity of household head). Standard errors are robust, and clustered at the location level.

Overall, attrition between the endline and baseline surveys was kept low at 8.8 percent. In Appendix C, we show that there is no differential attrition across treatment groups. Moreover, we present Lee bounds (Lee 2009) to specifically deal with the concern.

V. Results

A. Take-up and Trust

Column (1) of Table 2 shows that people invited to an "Informal Group meeting" attended a meeting 53 percentage points more than the control group in Area 1. The attendance of the control group to such meetings was 16 percent, despite them not being invited to a meeting, and them living in Area 1, distant from Area 2 by more than two hours by foot (roads are not tarred in this community). This illustrates that any intervention based on organizing group meetings can have important spillovers. In fact, the attendance rate in the "Control Group Spillover" (people not invited, but living in Area 2), is 46 percent, 30 percentage points more than the control group in Area 1. In any case, the important finding from Column (1) is that people invited to an "Informal Group Meeting" attended such a meeting significantly more than the control group. This difference in attendance allows us to study the causal impact of these meetings on take-up.

Column (2) of Table 2 shows that 10 percent of the people invited to an "Informal Group meeting" purchased the product (8 percentage points more than the control group, which took up at a rate of 2 percent). This is a large effect considering the minimal costs of organizing such meetings (0.7 USD per person), relative to subsidies (25 USD per person), which increased take-up by only 38 percentage point.

The difference between "Informal Group Meeting" and subsidies are even more striking one year after the start of the experiment, i.e., when the subsidies are discontinued. None of the persons that were eligible for a subsidy decided to purchase the product. In contrast, 6 percent of the persons invited to an "Informal Group Meeting" one year earlier decided to keep the product. This is quite a large effect considering the treatment only consisted in organizing one meeting.

Column (4) of Table 2 shows that trust in NHIF increased by 0.15 standard deviations.[17] In contrast, trust remains at similar levels, if anything decreases, in

[17]Answers to the question "Do you trust NHIF?" are collected on a 4 point scale (1. Distrust com-

Table 2—Impact of interventions on take-up and trust

	(1) Attend meeting	(2) Take-Up	(3) Retention	(4) Trust NHIF	(5) Know NHIF
Informal Group Meeting	0.53***	0.08***	0.06***	0.12**	0.12*
	(0.07)	(0.03)	(0.01)	(0.05)	(0.06)
Subsidy	0.00	0.38***	0.01	-0.08	0.10***
	(0.04)	(0.04)	(0.01)	(0.07)	(0.02)
Control Group Spillover	0.30***	0.04***	0.01	0.02	0.07
	(0.06)	(0.01)	(0.01)	(0.08)	(0.04)
Information	-0.09*	-0.00	-0.01**	0.07	-0.01
	(0.05)	(0.02)	(0.00)	(0.04)	(0.03)
Observations	1,201	1,201	1,201	1,195	1,201
R-squared	0.24	0.18	0.04	0.04	0.05
P-val Group vs Subsidy	0.00	0.00	0.00	0.02	0.74
Mean control group	0.16	0.02	0.00	3.41	0.41
SD control group	0.36	0.14	0.05	0.81	0.49

Note: OLS regressions. Robust standard errors in parentheses, clustered at the location level. *** p<0.01, ** p<0.05, * p<0.1. In Column (1), the dependent variable is a dichotomous variable equal to 1 if the individual attended a meeting, 0 otherwise. This variable is regressed on four dichotomous variables for the four groups created by the experimental design: people invited to an "Informal Group Meeting", people eligible for a subsidy, people not invited to the meetings but living close to those invited, i.e., in the "Control Group Spillover", and people receiving "Information" about the insurance product. The omitted category is those being in the control group in Area 1. In Column (2), the dependent variable is a dichotomous variable equal to 1 if the individual took up health insurance in the first year, 0 otherwise. In Column (3), the dependent variable is a dichotomous variable equal to 1 if the individual purchased health insurance in the second year, 0 otherwise. In Column (4), the dependent variable is trust in NHIF, where 1 indicates distrust, and 4 indicates complete trust. In Column (5), the dependent variable is a dichotomous variable equal to 1 if the individual answers yes to the question "Do you know NHIF?", 0 if the individual answers no or somewhat.

the subsidy group. This confirms that organizing group meetings, as opposed to distributing subsidies, reinforces trust in NHIF.

Being invited to an "Informal Group Meeting" increases the probability to know about NHIF by 12 percentage points, but not more than being eligible to receive a subsidy (10 percentage points). Therefore, the main difference between a group meeting and a subsidy was not knowledge, but trust.

Overall, Table 2 shows that some people trust and purchased health insurance after being invited to an "Informal Group Meeting". Short-run subsidies increased take-up in the short-run, but were not associated with trust and purchase two years later. The goal of the next section is to investigate the consequences of

pletely, 2. Somewhat distrust, 3. Somewhat trust, 4. Trust completely). The standard deviation in the control group is 0.8, thus the effect of the "Informal Group Meeting" is 0.12/0.8=0.15 standard deviations.

these interventions on risk-taking behavior.

B. High-health-risk high return activities

To do this, we face the choice of using an intent-to-treat analysis, or using our interventions as instrumental variables for the take-up of health insurance. We follow Banerjee et al. (2015), who focus on intent-to-treat estimates when analyzing the impact of an 8 percentage points difference in the take-up of microfinance between a treament and a control group. The reason is that the uninsured within the treatment group could also be affected by the interventions, which would violate the exclusion restriction assumption of an instrumental variable strategy: there could be spillover effects through informal insurance mechanisms,[18] effects working through the mere knowledge of being able to purchase a trustworthy insurance when needed,[19] and social learning effects driving technology adoption (Bandiera and Rasul 2006, Conley and Udry 2010, BenYishay and Mobarak 2013).

Table 3 shows that people take more health risks after being invited to an "Informal group meeting". The probability to use pesticides increases by 17 percentage points after a group meeting, over a baseline use level of 72 percent. The effect is larger than after receiving a full subsidy (only 9 percentage points).[20] The probability to grow cattle increases by 10 percentage points, from baseline levels of 24 percent. Considering the large returns of pesticides and cattle, one might expect a significant increase in incomes. In Column (3), we find that being invited to a group meeting increased risky agricultural income by 800 Ksh per month, per capita, i.e., 40 percent of income in the control group. This increase does not come at the detriment of income from less risky activities, as shown in Column (4). Overall, income increased by 22 percent, as shown in Column (5), in line with estimates from the literature on returns to pesticide and cattle.[21] This indicates the large hidden costs of insurance in terms of the choice of low-health-risk low-return activities.

Table D1 in Appendix D shows that this result does not depend on the set of control variables used. This table also shows that the effect is stronger for those who take up health insurance within the treatment group, further indicating that health insurance drives this result (although this result should be considered

[18] All 186 treated households live in the same area and are in the same groups. There could be negative spillover effects if formal insurance crowds out informal insurance. There could be positive spillover effects if insured households do not leave their groups, and instead contribute more to the hospital costs of others (thanks to larger resources due to engagement in higher-return activities).

[19] We were careful to remind people that there was a one month delay between registration and coverage.

[20] In a result not shown, the probability to use fertilizers increases by 6 percentage points, a lower effect than for pesticides, as expected given the less direct health threat of fertilizers versus pesticides.

[21] Pesticides doubles yields compared to organic farming (Valkila 2009). Thus, 17 percent new users would convert into a 17 percent increase in overall yields, and incomes. Dercon (1998) estimates that the returns to cattle are about 23 percent per year. Thus, 10 percent new cattle growers would convert into 2.3 percent increase in total per year. Overall, 17+2.3 is close to the 22 percent increase in income found in this paper.

carefully, since the decision to take up health insurance is endogenous).[22]

In sum, these results show that people undertake riskier activities, that increase their income. In the next section, we investigate whether these risky activities negatively affect health outcomes.

Table 3—Impact of interventions on high-health-risk high-return activities

	(1) Pesticide?	(2) Cattle?	(3) Risky inc.	(4) Not risky	(5) Inc.	(6) Log inc.
Informal Group Meeting	0.17***	0.10**	798.23**	217.45	973.86*	0.21***
	(0.03)	(0.04)	(340.58)	(201.92)	(512.88)	(0.07)
Subsidy	0.09**	-0.02	410.52	223.20	624.29	0.12
	(0.04)	(0.03)	(290.41)	(394.08)	(515.00)	(0.08)
Control Group Spillover	0.10*	0.03	437.20	157.01	829.81	0.13
	(0.05)	(0.03)	(265.50)	(210.00)	(730.77)	(0.08)
Information	0.07***	-0.04	110.54	665.60	565.10	0.03
	(0.02)	(0.02)	(227.36)	(603.06)	(773.58)	(0.08)
Observations	1,170	1,190	1,201	1,201	1,201	1,190
R-squared	0.04	0.02	0.10	0.03	0.06	0.16
P-val Group vs Subsidy	0.00	0.01	0.23	0.99	0.59	0.29
Mean control group	0.72	0.24	2011	1498	4301	7.92
SD control group	0.45	0.43	2377	3499	5528	1.00

Note: OLS regressions. Robust standard errors in parentheses, clustered at the location level. *** p<0.01, ** p<0.05, * p<0.1. In Column (1), the dependent variable is a dichotomous variable equal to 1 if the individual used pesticide, 0 otherwise. This variable is regressed on four dichotomous variables for the four groups created by the experimental design: people invited to an "Informal Group Meeting", people eligible for a subsidy, people not invited to the meetings but living close to those invited, i.e., in the "Control Group Spillover", and people receiving "Information" about the insurance product. The omitted category is those being in the control group in Area 1. In Column (2), the dependent variable is a dichotomous variable equal to 1 if the individual grew cattle, 0 otherwise. In Column (3), the dependent variable is agricultural income from risky activities (crops using pesticides, cattle, trees) (monthly, per capita). In Column (5), the dependent variable is income from non risky activities (crops not using pesticides, other livestock, formal sector work) (monthly, per capita). In Column (5), the dependent variable is total income (monthly, per capita). In Column (6), the dependent variable is log of total income (monthly, per capita).

C. Health outcomes

Considering we found an overall 40 percent increase in income from risky activities, hence in health-risk-taking, one could expect a 40 percent deterioration

[22]This table also shows in the last column that people do not falsely believe that they are covered by NHIF even though they did not purchase the insurance. In the last column, one can see that people who took up answer that NHIF will cover their medical bills, while this is not the case for treated people who did not take up NHIF.

in health outcomes directly related to work. After being invited to an "Informal Group Meeting", people do not suffer more from coughs (one of the direct symptoms of respiratory ailments from using pesticide, Column (1) of table 4). They are involved in more work accidents (Column (2)) and hospitalizations (Column (3)), although the effect is not significantly different from zero.[23] In fact, there is a decrease (not significantly different from zero) in total days of work/duties/school missing due to illness or disease by any household member (malaria, typhoid, work / duties accident, other household accident, permanent disability, heart problems, fatigue, old age) (Column (4)) in the past month.

The fact that people take more risks (as evidenced by the previous section, and confirmed in column (5) where $NumberRisks_i$ is the dependent variable) without any obvious health consequences may be explained by the extra protection used. We define $NumberAvoid_i$ as the count of protective actions taken in response to the three main risks in their work. In Column (6), the dependent variable is the ratio of $NumberAvoid_i$ to $NumberRisks_i$. It measures the fraction of protective actions taken in response to the risks faced. The baseline mean is 11 percent. This ratio may seem low, but can be explained by the fact that it is impossible to protect from some risks (e.g., exposure to weather). The important point is whether individuals invited to a group meeting protect themselves more or less than after any other interventions. Column (6) shows that individuals invited to a group meeting do not protect themselves less than the control group, if anything more, against the increased risks they faced. This extra protection may explain the lack of health consequences in the treatment group.

D. Informal insurance

Another side effect of the provision of formal health insurance might be to displace existing informal insurance networks and arrangements (Jowett 2003). This is important to know because the provision of formal health insurance may negatively affect uninsured households in the same informal insurance networks. Column (1) of Table 5 shows that more, not less, people report being involved in an informal group. Column (2) shows that people invited to an informal group meeting do not show a higher propensity to leave their group. Column (3) shows that the group is not more likely to dismantle in the next 5 years after receiving a group meeting. Column (4) shows that the hospitality, i.e., the amount one

[23]The absence of significant effects could be due to the rare occurence of work accidents and hospitalizations, and the inability of our sample size to detect such small effects. The probability of these events in the control group is 13 and 16 percent. We expect a 40 percent increase, hence a 5 and 7 percentage points increase in work accidents and hospitalizations. The effect detected (3 percentage points) is smaller than this, but not significantly different from 5 or 7. Hence, we cannot reject a 40 percent increase in work accidents and hospitalizations. Note that 5 and 7 percentage points are approximately the minimum detectable effect sizes for our sample. Consequently, our sample size is able to detect a 40 percent increase in work accidents and hospitalizations. We find similar results (i.e., increase in work accidents and hospitalizations, not significantly different from zero) when using as a dependent variable hospitalization at the individual level (4,805 individuals) rather than at the household, and clustering standard errors at the household level.

Table 4—Impact of interventions on health

	(1) Cough?	(2) Work Accid.?	(3) Hosp?	(4) Days sick	(5) # risks	(6) # avoid / # risks
Informal Group Meeting	-0.03	0.03	0.03	-0.38	0.24**	0.05
	(0.05)	(0.05)	(0.05)	(1.00)	(0.10)	(0.03)
Subsidy	0.04	0.03	0.00	0.51	0.29***	0.02
	(0.05)	(0.05)	(0.02)	(0.85)	(0.09)	(0.02)
Control Group Spillover	0.03	0.01	0.03	3.14***	0.05	0.01
	(0.09)	(0.04)	(0.03)	(1.14)	(0.09)	(0.02)
Information	-0.01	-0.00	0.03	0.26	-0.07	0.04**
	(0.05)	(0.02)	(0.04)	(0.69)	(0.05)	(0.02)
Observations	1,201	1,201	1,201	1,201	1,201	996
R-squared	0.057	0.028	0.054	0.191	0.098	0.030
P-val Group vs Subsidy	0.279	0.962	0.493	0.431	0.601	0.412
Mean control group	0.53	0.13	0.16	6.68	1.62	0.11
SD control group	0.66	0.36	0.42	14.26	1.14	0.27

Note: OLS regressions. Robust standard errors in parentheses, clustered at the location level. *** p<0.01, ** p<0.05, * p<0.1. In Column (1), the dependent variable is a dichotomous variable equal to 1 if the household head, spouse or children was hospitalized in the last two years, 0 otherwise. In Column (2), the dependent variable is the cost of all such hospitalizations. In Column (3), the dependent variable is a dichotomous variable equal to 1 if the household head, spouse or children had any work or duties accidents in the past month, 0 otherwise. In Column (4), the dependent variable is the total number of days missed from work, school, or daily duties due to malaria, typhoid, work or duties accident, other household accident, permanent disability, heart problems, fatigue, or old age, by the household head, spouse or children, in the past month. In Column (5), the dependent variable is the count of risks in the question "Please list the three main risks you face in your work / daily duties environment". Potential risks are: Exposure to weather, Burns / Explosions, Traffic Accidents, Cuts/pricks, Falling Items, Inhaling Chemicals, Other Air Pollution, Electric Shocks, Infectious Diseases, Poor Sanitation / Sewerage / Hygiene, Violence / Crime, Social Troubles, Exhaustion, Fatigue, Unclean Food, Overcrowding, Congestion, Noise, Body Aches, Falling, Dangerous Animals (e.g.. snakes, spiders). In Column (6), the dependent variable is the count of protective actions taken to avoid these risks (i.e., count of answers to the question: "What do you actually do to avoid these risks?". Answers are: wear gloves, wear ear protection, wear helmet, wear fume mask, wear other protective clothing, other), divided by the number of risks taken.

gets if one is hospitalized,[24] increases. Column (5) shows that after receiving a group meeting, the proportion of people who answer yes to the question "Say you are registered for NHIF. Then you fall sick and have to go to the hospital, but you are covered. Will your group still pay-out the same amount of "hospitality" regardless of your coverage?" remains the same as in the control group, and very high at 96 percent.

These results thus shows that formal insurance does not crowd out informal insurance. If anything, people report providing more, not less, hospitality. This points to positive spillovers of providing health insurance for other group members. This may explain why the effect on pesticide is even larger than the effect on take-up (17 versus 8). Of course, another explanation is social learning.

[24] "Hospitality" is the name given to the informal health insurance mechanism in these groups: after a group member is hospitalized, each group member contributes a set amount (usually 200 Ksh).

Table 5—Impact of interventions on informal insurance networks

	(1) Group?	(2) Left group?	(3) Group dismantle?	(4) Hospitality	(5) Hospitality and NHIF?
Informal Group Meeting	0.09	-0.03	0.10	1,647.82	0.01
	(0.06)	(0.04)	(0.17)	(1,117.51)	(0.02)
Subsidy	0.12***	-0.03	-0.06	669.69	0.02
	(0.04)	(0.02)	(0.15)	(430.97)	(0.02)
Control Group Spillover	0.03	-0.01	0.08	710.43*	-0.01
	(0.03)	(0.02)	(0.09)	(391.74)	(0.01)
Information	0.00	0.02	-0.06	197.28	0.01
	(0.02)	(0.03)	(0.08)	(573.41)	(0.01)
Observations	1,201	896	884	1,201	802
R-squared	0.099	0.010	0.033	0.077	0.018
P-val Group vs Subsidy	0.689	0.858	0.419	0.348	0.513
Mean control group	0.644	0.205	1.723	4097	0.964
SD control group	0.480	0.405	1.017	5257	0.186

Note: OLS regressions.Robust standard errors in parentheses, clustered at the location level. *** p<0.01, ** p<0.05, * p<0.1. In Column (1), the dependent variable is a dichotomous variable equal to 1 if the household head or spouse are involved in an informal group, 0 otherwise. In Column (2), the dependent variable is a dichotomous variable equal to 1 if the respondent answers yes to the question "Have you ever left a group or separated from a group and formed a new one?", 0 otherwise. In Column (3), the dependent variable is the answer to the question "On a scale of 1 to 5, 1 being completely unlikely and 5 being completely certain, how likely is it that your group will dismantle within the next 5 years?". In Column (4), the dependent variable is the amount of hospitality obtained from an informal group in case of hospitalization. In Column (5), the dependent variable is a dichotomous variable equal to 1 if the respondent answers yes to the question "Say you are registered for NHIF. Then you fall sick and have to go to the hospital, but you are covered. Will your group still pay-out the same amount of "hospitality" regardless of your coverage?".

VI. Conclusion

In this paper, we find that short-run subsidies of health insurance are not associated with long-lasting effects: 40 percent of our participants took up the offer in the first year, but none of them purchased the product in the second year when the subsidy was discontinued. We document that the effect may working through trust: two years laster, trust in the product did not increase. Unsurprisingly, people did not change their behavior: they did not engage in higher health-risk higher-return activities.

In contrast, an intervention based on social networks, where the product was explained to the targeted individual *together with* her/his existing informal group, which contains beneficiaries of the product who can speak to the promise of insurance, was found to have significant effects. Despite the low costs of organizing

such meetings and the absence of any subsidies, we found that this intervention raised purchase to 10 percent, and increased trust in the product by 0.15 standard deviations. Two years later, treated households were found to engage more in high-health-risk high-return activities, i.e., they used more pesticides, chose more crops that need pesticide, and grew more cattle. The effect on incomes were substantial, a 22 percent increase. People also took more precautions, such that health outcomes did not massively deteriorate. Informal health insurance mechanisms were not crowded out, which resulted in positive spillovers for uninsured households.

This paper generates important implications for developing countries committed to the goal of universal health coverage to increase the health of their population and decrease poverty rates, but who are also budget-constrained. First, it provides rigorous evidence as to how health insurance can be a powerful instrument for development, as recently argued by international organizations (WorldBank 2014). Second, it shows a fiscally sustainable way to reach the goal of universal health coverage. We find that presenting information on health insurance to informal groups increases formal health insurance take-up and trust in a cost-effective way. This methodology is applicable to other contexts since informal groups are a pervasive phenomenon in developing countries, under the name of Rotating Savings and Credit Associations (Roscas), Chit funds, self-help groups, sub-castes in India (Mobarak and Rosenzweig 2012), Tontines in West Africa, susu in Ghana (Besley et al. 1993), Idirs in Ethiopia (Dercon et al. 2014).

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Appendix A: Representativeness of sample

Table A1—Representativeness of sample

	Baseline data (2007)	Central Prov. Rural	Source	Cohen-d values (p-values)
Household Head Age	47.57	47.32	Census 2009	0.01
				(0.42)
Water Source: River/Pond/Stream	0.37	0.37		0.01
				(0.60)
Income	5050	4548	KIHBS 2005	0.08
				(0.02)
Religion: Protestant	0.54	0.52		0.05
				(0.15)
Walls: Stone	0.14	0.17		0.14
				(0.05)
Distance to Water (min)	11.23	11.42		0.02
				(0.71)
Has Car	0.056	0.041	DHS 2008	0.07
				(0.06)
Household Head Education	8.34	7.00		0.29
				(0.00)
Number of Children	1.59	1.68		0.06
				(0.08)

Note: The values displayed next to each outcome are Cohen-d values adjusted for uneven group size. A Cohen-d value of 0.2 corresponds to a small effect size, 0.5 to a medium effect size, and 0.8 to a large effect size. The values in parentheses are p-values. The first two variables come from the 1009 Kenya Population and Housing Census, the next four from the Kenya Integrated Household and Budget Survey (2005), and the last three from the Kenya Demographic and Health Survey (2008).

Appendix B: Theoretical model

Suppose an individual can choose between a safe project for one's health (using no pesticide, i.e., organic farming, growing chickens), and a higher-health-risk higher-return project (using pesticide, growing cattle). The safe project returns a utility u_0 for sure. The other project is risky for the individual's health: with probability p, the individual suffers a health shock (respiratory problem after pesticide use, accident with cattle) that necessitates the payment of medical costs c. But the risky project has high financial returns y.[25] The risky project may also have some other costs E associated with it (distaste for environmental degradation caused by pesticide (water pollution, deaths of bees, fish, birds), distaste of being sick even though medical treatment is given). The expected utility associated with this risky project is:

[25]In the context of organic versus conventional coffee farming, organic yields are half of conventional yields, while organic price premium was 8 percent in 2008 (Valkyla, 2009). Thus, if $y = yields.price$, then $y_{organic} = \frac{1+0.07}{2} y_{conventional} = 0.54.y_{conventional}$

$$EU = (1-p)u(y) + pu(y-c) - E$$

A health insurance product can be purchased at premium β, and reimburses α in case of an accident, net of the premium. Thus, the expected utility associated with the risky project under insurance is:

$$EU_I = (1-p)u(y-\beta) + pu(y-c+\alpha) - E$$

Health insurance makes the risky project more desirable if and only if:

$$\begin{aligned} EU_I \geq EU \quad &\Leftrightarrow \quad (1-p)u(y-\beta) + pu(y-c+\alpha) \geq (1-p)u(y) + pu(y-c) \\ &\Leftrightarrow \quad -(1-p)(u(y)-u(y-\beta)) + p(u(y-c+\alpha)-u(y-c)) \geq 0 \end{aligned}$$

The first term represents the decrease in utility due to the payment of insurance premium β in $(1-p)$ of the cases (i.e., the pain of insurance). The second term represents the increase in utility due to the repayment of medical costs α when an accident occurs, i.e. with probability p (i.e., the gain of insurance). Figure B1 below shows the pain and gain of insurance for a risk-averse individual (i.e., concave utility function).

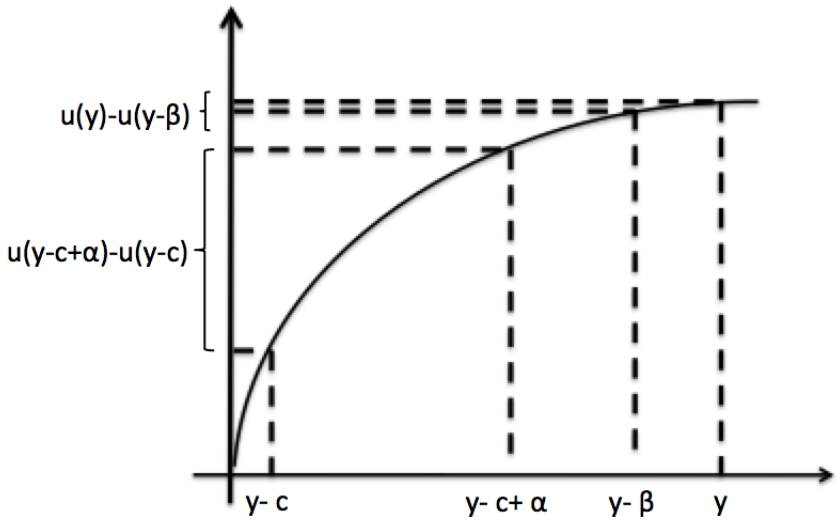

Figure B1. The pain and gain of insurance

On this graph, the term $u(y)-u(y-\beta)$ represents the pain of insurance (having to pay an insurance premium). For such a risk-averse individual, that pain can be minimal if income from the high-return project is so high that the utility curve is in a flat part. The term below $u(y-c+\alpha)-u(y-c)$ represents the gain of

insurance (reimbursement of medical costs). For such a risk-averse individual, that gain might be massive, considering the curvature of the curve at low levels of income caused by medical costs c. Of course, that gain is extremely rare, it occurs only in case of an accident, with probability p. Thus, knowing whether the pain is greater than the gain depends on the particular value of the parameters used.

More definite answers can be given for extreme values of the parameters. Suppose first that β is zero, i.e., health insurance is free. There is no pain of insurance, only a gain. In that situation, health insurance makes the risky project more desirable. This does not obviously mean that the farmer will choose the risky project over the safe one. Poor farmers may have been already taking maximum risks without health insurance ($u_0 \leq EU \leq EU_I$). In contrast, distaste for environmental degradation E may be so large as to prohibit farmers from choosing the risky activity ($EU \leq EU_I \leq u_0$). Only if the parameters are such that ($EU \leq u_0 \leq EU_I$) will we observe a change in risk-taking behavior. Hence, the Proposition 1 of the paper: subsidized insurance ($\beta = 0$) may increase risk-taking behavior, income, and welfare.

Suppose now people do not believe that they will be reimbursed by this product in case of an accident, thus $\alpha = 0$. There is no gain of insurance. Even if health insurance were free ($\beta = 0$), it will not make the risky project more desirable. In fact, minimal transaction costs associated with taking up the subsidy (filling the forms, providing ID and birth certificates, sending the application) could make the risky project less, not more, desirable. In this case, people would not even take up the subsidy. Subsidized insurance may thus have no effect on risk-taking: if people do not trust the product, they will not change their behavior in the first place.

If the probability of repayment were to be exogenously increased ($\alpha \nearrow$), then the gain of insurance would increase $((\partial EU)/(\partial \alpha)) = pu\prime(y - c + \alpha) > 0$), and the risky activity would be more desirable. This could be true even for even high values of β (unsubsidized insurance). This leads to our second proposition of the paper: an exogenous increase in the probability of repayment, even coupled with high insurance premiums (unsubsidized but credible insurance), such that $EU \leq u_0 \leq EU_I$, will increase risk-taking behavior, income, and welfare.

Some support for these propositions can be found in open-ended qualitative interviews. We asked our respondents "If you had health insurance reimbursing all the hospitalization costs, would you engage more in the high-health-risk high-return activities?" One respondent answered: "Yes, very much, since with health insurance, I would feel more comfortable doing them". Another respondent answered: "Maybe *if insurance reimbursed all of my money*, I would involve in more risky activities" (italics added for emphasis). In accordance with our model, this points to issues of trust with the health insurance product.

However, other answers to the same hypothetical scenario did not support these propositions. One respondent said: "With or without NHIF coverage, I would

prefer to have a casual laborer helping me". In other words, the health risks can be avoided by hiring somebody else to take them on. Health insurance may thus not engage people in higher-health-risk higher-return activities. Another respondent answered: "No. Even if NHIF did not pay, I would still do the dangerous tasks as I must get money for rent, clothing, and children's fees". Poor people might be taking maximum health risks with or without health insurance to sustain their families, such that $EU \geq u_0$. In this case, offering health insurance will not affect risk-taking behavior. Another respondent said: "No. I would not engage more in these activities because I would still undergo a painful experience, even if I get free medication". this points to large disutility costs of being sick E, such that $EU \leq EU_I \leq u_0$. Overall, there is no obvious support for the main claim of this paper from answers to a hypothetical scenario.

Appendix C: Attrition

Overall, attrition between the endline and baseline surveys was kept low at 8.8 percent. We define $Attriter_i$ as 1 if individual i is observed in the baseline but not the follow-up survey, 0 if observed in both rounds. We then regress this variable on our four intervention dummies, and on baseline characteristics, to identify whether there is differential attrition across treatment groups, and whether attriters share common characteristics.

Results are shown in C1. Column (1) finds no significant differential attrition across treatment groups. To further account for attrition in our survey, we present Lee bounds (Lee, 2009). The intuition of this methodology is simple. The attrition rate in the "informal group meeting" group is 3.8 percent, while the attrition rate in the control group is 10.6 percent. The difference in attrition is "marginal" people who are induced to participate in the follow-up survey because of the treatment. The proportion of marginal people among non missing people in the "informal group meeting" group is (96.24-89.4)/96.24=7 percent. The worst-case scenario for our estimates is if these marginal people are at the top of the distribution of our outcomes of interest, say use of pesticide. In other words, the marginal people attend a meeting, increase significantly their use of pesticide, increase their income, and are induced to answer our follow-up survey because of this. We thus trim the upper 7 percent of the use of pesticide distribution in the "informal group meeting" group, to get the lower bound of the treatment effect. Conversely, the best-case scenario for our estimates is if these marginal people are at the bottom of the distribution of use of pesticide. We thus trim the lower 7 percent of the use of pesticide distribution, to get the upper bound of the treatment effect. Column (2) finds that the lower bound of the treatment effect is still significantly positive. The rest of the columns show Lee bounds for our main outcomes of interest. None of the lower bounds are negative and significant. This indicates that differential attrition across treatment groups is unlikely to be a concern.

Table C1—Attrition

	(1) Attriter	(2) Pesticide?	(3) Cattle?	(4) Risky inc.	(5) Log inc.
Informal Group Meeting	-0.00				
	(0.01)				
Subsidy	-0.01				
	(0.01)				
Control Group Spillover	-0.01				
	(0.01)				
Information	-0.01				
	(0.01)				
Lower bound		0.14***	0.10**	-112.96	-0.02
		(0.04)	(0.04)	(228.14)	(0.10)
Upper bound		0.26***	0.11***	1,117.37***	0.37***
		(0.04)	(0.04)	(410.77)	(0.10)
Observations	828	534	534	534	534
R-squared	0.020				

Note: In Column (1), the dependent variable is a dichotomous variable equal to 1 if the individual is observed at baseline, not at endline, 0 if observed in both rounds.
log total income (monthly, per capita). Column (2) includes control variables. Column (3) includes "Take-up in Group", a dichotomous variable equal to 1 if the individual took up health insurance after being invited to a group meeting, 0 otherwise. Column (3) also includes "Take-up Subsidy", a dichotomous variable equal to 1 if the individual took up health insurance after a subsidy, 0 otherwise. In Column (4), the dependent variable is a dichotomous variable equal to 1 if the individual answers NHIF to the question "How do you pay your medical bills?", 0 otherwise.

Appendix D: Robustness checks

Table D1—Robustness checks

	(1)	(2)	(3)	(4)
	Log total income per cap			NHIF pays bills
Informal Group Meeting	0.15**	0.21***	0.17***	-0.00
	(0.06)	(0.07)	(0.06)	(0.02)
Subsidy	0.14	0.12	0.10	-0.05*
	(0.09)	(0.08)	(0.07)	(0.03)
Control Group Spillover	0.10	0.13	0.13	0.02
	(0.09)	(0.08)	(0.08)	(0.04)
Information	0.01	0.03	0.03	-0.03
	(0.09)	(0.08)	(0.08)	(0.02)
Take-up in Group			0.37**	0.30***
			(0.14)	(0.06)
Take-up Subsidy			0.04	0.20***
			(0.14)	(0.07)
Age of HH head		0.00	0.00	0.00**
		(0.00)	(0.00)	(0.00)
Education of HH head		0.05***	0.05***	0.01***
		(0.01)	(0.01)	(0.00)
HH head female		-0.31***	-0.31***	-0.06**
		(0.05)	(0.05)	(0.03)
HH size		-0.23***	-0.23***	-0.00
		(0.01)	(0.01)	(0.00)
Risk-Aversion		-0.02	-0.02	-0.02
		(0.08)	(0.08)	(0.02)
Time preferences		-0.06	-0.06	-0.04
		(0.08)	(0.08)	(0.03)
Religiosity		0.02	0.02	-0.00
		(0.01)	(0.01)	(0.00)
Observations	1,247	1,190	1,190	1,189
R-squared	0.004	0.161	0.163	0.048
P-val Group vs Subsidy	0.853	0.290	0.470	0.117
Mean control group	7.924	7.924	7.924	0.113
SD control group	1.002	1.002	1.002	0.317

Note: OLS regressions. Robust standard errors in parentheses, clustered at the location level. *** p<0.01, ** p<0.05, * p<0.1. In Columns (1) to (3), the dependent variable is log total income (monthly, per capita). Column (2) includes control variables. Column (3) includes "Take-up in Group", a dichotomous variable equal to 1 if the individual took up health insurance after being invited to a group meeting, 0 otherwise. Column (3) also includes "Take-up Subsidy", a dichotomous variable equal to 1 if the individual took up health insurance after a subsidy, 0 otherwise. In Column (4), the dependent variable is a dichotomous variable equal to 1 if the individual answers NHIF to the question "How do you pay your medical bills?", 0 otherwise.