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Evidence from China

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Agriculture

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About this report

A randomised evaluation of the effects of an agricultural insurance programme on rural households' behaviour: evidence from China

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Acknowledgements

Abstract

This project analyzes the determinants of adoption of a new weather insurance product in China and the impact of insurance provision on farmer behavior.

First, we analyze the role of social learning and contract design in improving the diffusion of a new insurance product. The study sites include over 200 randomly selected villages in Jiangxi province of China, with around 8,000 households. In order to examine the causal effect of financial education and social learning on insurance take-up, households were randomly assigned to different treatment and control groups. The study has six main findings: (i) we find that financial education about insurance and its benefits improves take-up by 15 percentage points (from 35 per cent to 50 per cent) or 43 per cent of its base value; (ii) we observe large positive spillover effects of financial education on adoption by others: having one additional close friend attending training is equivalent to 50 per cent of the direct training effect, equivalent to the impact of reducing the average insurance premium by 15 per cent; (iii) this spillover (social network) effect is driven by the diffusion of knowledge (farmers who have more friends exposed to financial training perform significantly better on an insurance knowledge test), rather than by trust, imitation (the uptake decisions of other villagers, even close friends, do not significantly influence behavior because this information is not shared through the social network), or informal risk- sharing; (iv) in the long run, farmers who have more friends receiving an insurance payout in the previous year are 23.6 per cent more likely to buy insurance in the second year. That effect is equivalent to 50 per cent of the effect of directly receiving a payout; (v) cost-sharing subsidy policies are better than free distribution policies for the long-run development of such insurance programs; (vi) offering a menu of insurance contracts rather than a single contract increases take-up dramatically.

Second, we take advantage of exogenous variation in baseline insurance take-up generated by the financial education treatment to identify the causal effect of insurance provision on households' production, saving, and borrowing decisions. We find that households increased production of insured crops, but the effect is not statistically significant. Moreover, households did borrow more and were more likely to repay the loan after insurance was purchased; however, again these effects are not statistically significant. Finally, there is no significant effect of insurance provision on saving.

It is very early to derive policy recommendations based on a two-year study of the introduction of a brand new financial product that is difficult to understand. However, it is clear that, first, social networks are important in helping people understand and adopt this new product, and hence the insurance company should continue to share the information on people's decisions to insure and on payouts distributed. Second, making sure that people understand the product is critical and worth several points of subsidies. It is a very cost-effective marketing tool. Third, in so far as the government is willing to subsidize the insurance, this is definitely welfare enhancing for the farmers. Two years is, however, too short to see how farmers will adjust their production, saving, and borrowing behavior. Nevertheless, there are some indications that they indeed respond by increasing investment in production, a very encouraging result. This will need to be confirmed in follow-up studies.

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List of figures and tables

Abbreviations and acronyms

PICC   People's Insurance Company of China
RMB   Renminbi
RCC   Rural Credit Cooperatives
IV   instrumental variable

1. Introduction

Poor households in rural areas are vulnerable to losses from negative weather shocks. To protect themselves from these shocks, they engage in costly ex-ante risk-mitigation strategies, such as avoiding high-risk-high-return agricultural activities, setting aside high levels of precautionary saving, and making insufficient investment in production. A negative shock, the foregoing of profitable investment opportunities, and the reduction of human capital accumulation can lead to persistent poverty.

A potential way to shield farmers from risks and reduce poverty is to provide formal weather insurance products. However, in many cases, such insurance products exist but their use is not widespread. For example, in India, the take-up rate of rainfall insurance is only around 4.6 per cent; in China, even with 70 per cent government subsidy, take-up of weather insurance is still only around 15 per cent. These findings suggest a puzzle: why do so few households purchase insurance coverage when weather insurance markets are available, and expected benefits are large? In the first part of this project, we measure the following determinants of insurance take-up: financial education, social learning, and contract design. Moreover, while many developing countries are making efforts to enhance the rural insurance market, there is little research that examines the impact of providing insurance to rural households. Understanding the benefit of such programs is important in order to determine whether they should be extended. The second part of our project studies the impact of insurance provision on the production, borrowing, and saving behavior of rural households.

We use a two-year randomized experiment in rural China to answer the above questions in the context of the introduction of a new weather insurance product. The experimental sites include over 200 randomly selected villages in Jiangxi province of China. The study design and the results are as follows. First, to estimate the effect of financial education on insurance take-up, we provided intensive education about weather insurance to a randomly selected subset of farmers. We find that financial education improves take-up significantly, by around 45 per cent (from 35 per cent to 50 per cent). Second, to study the social learning effect, we estimate the spillover effect of financial education on untreated farmers. The spillover effect is equivalent to decreasing the average insurance premium by 15 per cent. Moreover, we show that the spillover effect is driven by learning about insurance, rather than by imitation, scale effects, or informal risk-sharing. Third, we followed up one year later with a subsample of households from the first year experiment to study the effect of receiving payouts and learning from friends' experience. We find that having an above median share of friends receiving payouts increases the second year take-up, and that this effect is equivalent to reducing the average insurance premium by 35 per cent, and is as effective as about 54 per cent of the impact of receiving an actual payout. The learning effect is higher under a partial subsidy policy (i.e., with cost-sharing) than under a full subsidy policy. Fourth, to study the effect of contract choices on take-up, we offered a menu of contracts to a randomly selected subsample of farmers. We find that this simple action of exercising choice increases the take-up rate by 30 per cent. Fifth, to evaluate the impact of this intervention, we take advantage of exogenous variation in baseline insurance take-up generated by the

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financial education treatment to identify the causal effect of insurance provision on households' production, saving, and borrowing. We find that households increased the production of insured crops; however, the effect is not statistically significant. Moreover, households did borrow more and were more likely to repay the loan after insurance were purchased. However, again those effects are not statistically significant. Finally, there is no significant effect of insurance provision on saving.

The rest of the report is organized as follows. Section 2 describes the background for the study and the insurance contract. Section 3 explains the experimental design. Section 4 presents the results, and Section 5 presents the policy implications. Results on the role of social networks are reported in Section 4.1. Results on short- and long-run subsidies in Section 4.2, on contract choice and insurance take-up in Section 4.3, and on production, saving, and borrowing responses in Section 4.4 are preliminary. Detailed results with supporting figures and tables will be available when the corresponding papers are posted on the authors' Web Pages or published.

2. Context

2.1   Background

Rice is the most important food crop in China, with nearly 50 per cent of the country's farmers engaged in its production. In order to maintain food security and shield farmers from negative weather shocks, in 2009 the Chinese government requested the People's Insurance Company of China (PICC) to design and offer the first rice production insurance policy to rural households in 31 pilot counties.[1] The program was expanded to 62 counties in 2010 and to 99 in 2011. The experimental sites for this study were 185 randomly selected rice production villages included in the 2010 expansion of the insurance program, located in Jiangxi province, one of China's major rice bowls. In these villages, rice production is the main source of income for most farmers. Because the product was new, no household had ever heard of or purchased such insurance before, and most of them had never interacted with PICC. As a result, farmers, and even government officials at the village or town level, had a very limited understanding of weather insurance products and were unfamiliar with the insurance company.

The insurance contract is as follows. The actuarially fair price is 12 Renminbi (RMB) per mu per season.[2] The government gives a 70 per cent subsidy on the premium, so farmers only pay the remaining 3.6 RMB per mu.[3] Such governmental subsidies for

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[1]Although there was no insurance before 2009, if major natural disasters occurred, the government made payments to households whose production had been seriously hurt. However, the level of transfer was usually very low and far from sufficient to help farmers resume production.

[2]1 RMB = 0.15 US\$; 1 mu = 0.067 hectare. In the experimental sites, farmers produce two or three crops of rice each year. The actuarially fair price was calculated based on the average probability of disaster and yield information at the national level. Some people however think that this county is less risk-prone than the national average, and hence that the fair price is somewhat lower than 12 RMB. In any case, the price of 3.6 RMB at which the insurance is sold is heavily subsidized, and hence this does not affect our welfare statement.

[3]According to our price randomization experiment, the take-up rate is close to zero when the post-subsidy price is larger than 8 RMB. As a result, subsidies were essential to do the network study as otherwise the extremely low take-up rate would have made the analysis difficult.

agricultural insurance are common in both China and other countries. If a farmer decides to buy the insurance, the premium is deducted from the rice production subsidy deposited annually in each farmer's bank account, with no cash payment needed.[4] The insurance covers natural disasters, including heavy rain, flood, windstorm, extremely high or low temperatures, and drought. If any of these natural disasters occurs and leads to a 30 per cent or more loss in yield, farmers are eligible to receive payouts from the insurance company. The amount of the payout increases linearly with the loss rate in yield, from 60 RMB per mu for a 30 per cent loss to a maximum payout of 200 RMB per mu[5]. The loss rate in yield is determined by a committee composed of insurance agents and agricultural experts. Since the average gross income from cultivating rice in the experimental sites is between 700 RMB and 800 RMB per mu, and the production cost is around 300 RMB to 400 RMB per mu, this insurance policy covers 25 to 30 per cent of the gross income or 50 to 70 per cent of the production cost. Consequently, with the subsidy provided, we can safely assume that it is optimal for all rice farmers to purchase the insurance.

Note that because the most frequent disaster that happens in this region is due to wind, damages are very local. When windstorms happen, how much you lose really depends on the location of your plot. For example, in the first year, the percentage loss in yield experienced by farmers varied from 0 per cent to over 80 per cent.

2.2   Literature Review

This project relates to the existing literature in the following ways. First, our project sheds light on the challenge of how to improve weather insurance take-up. Existing research has tested possible explanations for low take-up such as lack of trust, credit constraints, or ambiguity aversion (Giné *et al.* 2008; Cole *et al.* 2013a; Bryan 2013), but insurance demand remains low even after some of these barriers were removed in experimental treatments. We provide evidence on the role of scalable instruments in improving insurance adoption, such as combining intensive financial education to a subset of households with reliance on social networks to amplify the effect and boost participation rates, and combining subsidy or marketing strategies with social norms marketing in which we disseminate information to the full population about the behavior of peers.

Second, the project provides new insights on the insurance impact literature. Estimating the causal effect of insurance policy on household behavior is made challenging by endogeneity of the insurance purchase decision. There are a few papers studying the effects of insurance markets on household investment, welfare, and loan repayment, using different estimation strategies. For example, Cole *et al.* (2013b) used a randomized experiment which provided free rainfall insurance for a selected group of landowner farmers in a semi-arid area of India, and found that

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[4] Starting in 2004, the Chinese government has provided production subsidies to rice farmers in order to give them more production incentives. Each year, subsidies are deposited directly to the farmers' agricultural cards in the rural credit cooperatives (the main rural bank of China).
[5] For example, consider a farmer who has 5 mu in rice production. If the normal yield per mu is 500kg and the farmer's yield decreased to 250kg per mu because of a windstorm, then the loss rate is 50 per cent and he will receive 200*50 per cent = 100 RMB per mu from the insurance company.

provision of insurance induced farmers to shift production towards higher-return but higher-risk cash crops. Giné and Yang (2009) implemented a field experiment in Malawi which offered crop technology loans to 800 maize producers and randomly bundled insurance with loans for half of them. They found the surprising result that the take-up of loans was 13 per cent lower for producers who were offered insurance with a loan. Carter *et al.* (2007) analyzed two index-based insurance schemes in Peru and used simulations to show that insurance provision did significantly improve producers' welfare, credit supply, and loan repayment. In contrast, Rosenzweig and Wolpin (1993) show by simulation that the gain from weather insurance for Indian farmers was minimal due to the existence of informal insurance mechanisms. This project complements the existing literature by using experimental methods to test the causal effect of insurance provision on households' production, borrowing, and saving behavior, taking advantage of the detailed administrative data from the rural bank.

Third, this project furthers our understanding of social networks. While the study of social network mechanisms is crucial from both theoretical and policy perspectives, only a few studies to date have shed light on this point. For example, Kremer and Miguel (2007) found negative peer effects on the uptake of deworming pills, which effectively rules out explanations such as imitation and learning how to use the product. Banerjee *et al*. (2013), based on the estimation of a structural model, find that acquiring information from friends is the most important channel for the decision on microfinance participation. By contrast, Maertens (2012) used a survey design to study the adoption of Bt cotton and finds that both acquiring knowledge from others about product profitability and imitating others' behavior contribute to individual adoption rates. This study extends the existing literature by using experimental design to directly identify a comprehensive set of generic channels through which social networks operate.

Finally, this project adds insights to the literature on financial education. Although correlational evidence indicates that individuals with low levels of financial literacy are less likely to participate in financial markets (Lusardi and Tufano 2009; Lusardi and Mitchell 2007; and Stango and Zinman 2009), experimental research on the value of financial education provides mixed results. For example, Duflo and Saez (2003) and Cole *et al.* (2013a) find small or no effects of financial education on individual decisions. By contrast, Cai and Song (2014), and Cole *et al*. (2011) all find positive and significant effects. In a context where insurance is new, and farmers have relatively low levels of formal education, our results show that lack of financial education is a major constraint on the demand for insurance, and that modest financial training can significantly improve take-up rates.

3. Experimental design and summary statistics

3.1 Identify the effect of financial education and social networks on take-up

The first experiment identifies the financial education effect, plus the role and functioning of social networks in influencing insurance demand. The experiment was

carried out in the Spring of 2010, and included 185 villages with a total of 5,332 households.[6]

In order to generate household-level variation in the knowledge and understanding of insurance products, two types of information sessions were offered to different households: simple sessions that took around 20 minutes, during which the PICC agents introduced the insurance contract;[7] and intensive sessions that took around 45 minutes and covered all information provided during simple sessions, plus financial education to help the farmers understand how insurance works and what are its expected benefits.

In each village, two rounds of sessions were offered to introduce the insurance program. During each round, there were two sessions held simultaneously, one simple and one intensive. To allow time for information sharing by first round participants, we held the second round sessions three days after the first round.[8] The effect of social networks on insurance take-up is thus identified by looking at whether second round participants are more likely to buy insurance if they have more friends who were exposed to financial education in first round intensive sessions.

The experimental design is illustrated in Figures 1.1 and 1.2. There are four randomizations in this experiment, two at the household level and two at the village level. The within-village household-level randomizations are presented in Figure 1.1. First, households in the sample were randomly assigned to one of the four sessions: first round simple (T1), first round intensive (T2), second round simple (T3), or second round intensive (T4).[9] This randomization accounts for exogenous variations among second round participants in the proportion of their group of friends exposed to first round financial education, and hence helps identify the causal effect of social networks within villages.

Second, for each second round session, after the presentation and before participants were asked to make their final decisions, we randomly divided them into three groups and disseminated additional information that was different for each group. Specifically, farmers in groups U1 and U4 received no additional information from us but were directly asked to make take-up decisions; these farmers thus received exactly the same information from us as those in the two first round sessions (T1 and

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[6] In this experiment, 'villages' refers to the 'natural villages' in rural China, which are a smaller unit than 'administrative villages'. A natural village typically has 30 to 40 households, while an administrative village usually includes 5 to 10 natural villages.

[7] The simple session explains the terms of the contract including the insurance premium, the amount of subsidy provided by the government, the responsibility of the insurance company, the maximum payout, the period of responsibility, rules of loss verification, and the procedures for making payouts.

[8] We decided to leave three days between the two rounds because, based on conversations with village leaders, this was considered long enough to allow farmers to discuss the insurance program with each other, and short enough for farmers not to forget what they had discussed.

[9] Before doing randomizations, we first approached the leaders of each village to obtain a list with the names of all household heads and basic household characteristics. Households who did not grow rice were excluded. For all household-level randomizations in this experiment, we stratified the sample within each village according to household size and area of rice production per capita, and randomly assigned households to different treatment groups in each stratum. Only household heads were invited to attend one of the four sessions. No one could attend more than one session. In order to guarantee a high session attendance rate, we gave monetary incentives to village leaders and asked them to inform and invite household heads to attend these sessions.

T2). For farmers in groups U2 and U5, we told them the overall attendance and take-up rate at the two first round sessions in their village. For farmers in groups U3 and U6, we showed them the detailed list of purchase decisions made in the two first round sessions, so that they knew specifically who had purchased the insurance and who had not. This part of the experiment was designed to help determine the main mechanisms that drive the social network effect.[10]

Figure 1.1 Experimental design: within-village, household-level randomization
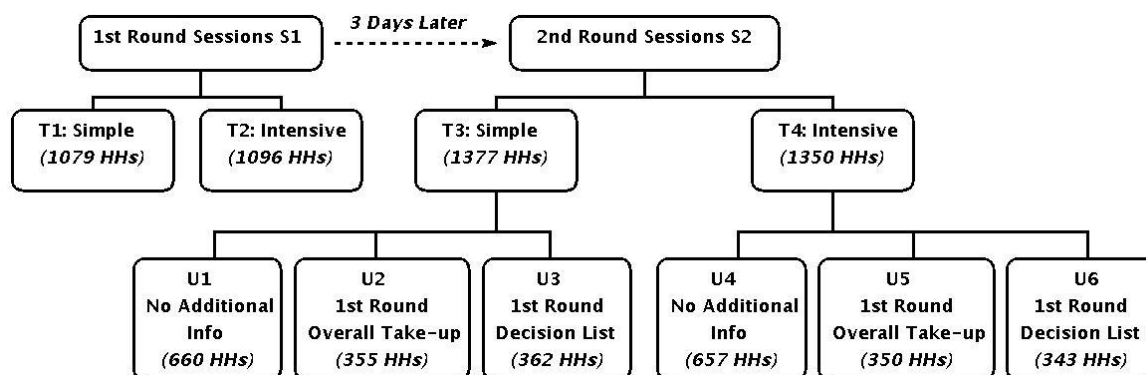
The village-level randomizations are shown in Figure 1.2. First, we randomly divided villages into two types. In type I villages (all households face the same price of 3.6 RMB per mu. By contrast, in type II villages, we randomly assigned one of seven different prices ranging from 1.8 to 7.2 RMB per mu to different participants.[11]The price randomization in type II villages allows us to measure the monetary value of the social network effect. The second village-level randomization was only within type I villages. We randomized the default option to buy in first round sessions. If the default was BUY, the farmer needed to sign off if he or she did not want to purchase the insurance; if the default was NOT BUY, the farmer had to sign on if he or she decided to buy the insurance.[12] Both groups otherwise received exactly the same pitch for the product. Default options were the same in the two first round sessions within each village. The objective of offering different default options was to generate exogenous variations in the first round insurance take-up across villages which could be used in some estimations as an instrumental variable for first round purchase

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[10] Note that the number of households in the no information group (U1 and U4) is close to the number of households in the information group (U2, U3, U5, U6).

[11] In all type II villages, farmers in second round sessions T3 and T4 received exactly the same information as households in first round sessions T1 and T2, respectively. No additional first round take-up information was provided after the presentation. This sample is also included in the social network analysis.

[12] During sessions where default = BUY, before insurance agents asked farmers to make decisions, instructors told them the following: 'We think that this is a very good insurance product, and we believe that most farmers will choose to buy it. If you have decided to buy the insurance, there is nothing you need to do, as the premium will be deducted automatically from your agricultural card; if you do not want to buy it, then please come here and sign.' During sessions where default = Not Buy, farmers were told: 'We think that this is a very good insurance product, and we believe that most farmers will choose to buy it. If you have decided to buy the insurance, please come here and sign, then the premium will be deducted from your agricultural card; if you do not want to buy it, there's nothing you need to do.'

decisions.[13] In all cases, households had to decide whether to purchase the insurance individually at the end of the information session.

Figure 1.2 Experimental design: village-level randomization
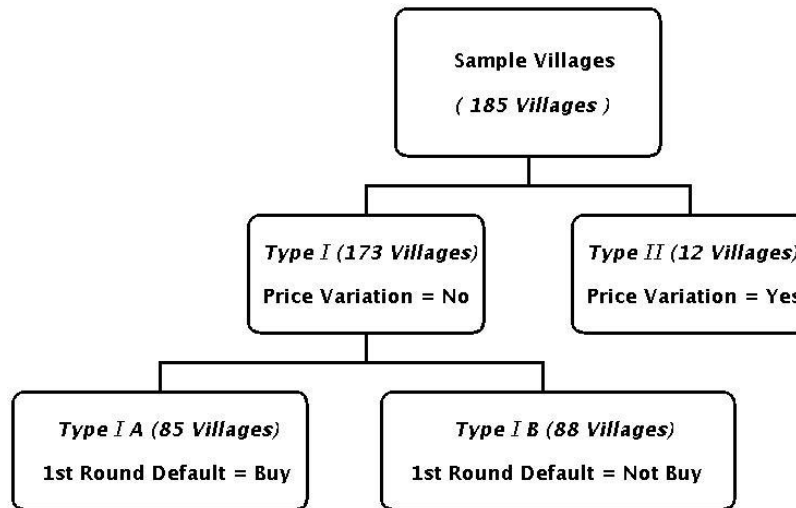
3.2   Short-run subsidy policies and long-run insurance take-up

Whether free distribution or cost-sharing subsidy policies are better for the long run development of insurance programs is not clear: while full subsidy policy can guarantee a high coverage and let more people learn about insurance benefits by receiving or observing payouts (higher spillover effect), there are also disadvantages. First, it will be more difficult to maintain adoption rates if subsidies are removed even partially because of a price anchoring effect (farmers may treat the previous price as the reference point, if that happens, they will be less likely to buy the insurance if the post-subsidy price is higher in future years); second, the payout and learning effect might be smaller (there can be different reasons such as less attention, loss aversion). As a result, in order to figure out which subsidy policy can better maintain long run adoption and financial sustainability, we need to study how do follow-up demand and price sensitivity differ under alternative subsidy policies.

The original premium of the rice insurance was 12 RMB per mu per season. In the first year, among type I villages where there's no price variation, in a randomly selected sub-group of villages, there was a 70 per cent government subsidy, which meant farmers only needed to pay 3.6 RMB. In other villages, the insurance was given free. If natural disasters such as drought or windstorm occurred and led to 30 per cent or more loss in yield, the insurance company would come to check loss and make reimbursement. The maximum payout was 200 RMB per mu, which covers around two thirds of the production cost. The exact payout that you can get depends on the loss rate. In order to estimate demand functions for insurance in the second year, we randomly assigned to households nine prices with subsidies ranging from 30

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[13] According to Beshears *et al.* (2010), default options can influence households' financial decisions significantly due to the complexity of the decision, endorsement effects, or procrastination.

per cent to 90 per cent: 1.2, 1.8, 2.7, 3.6, 4.5, 5.4, 6.3, and 7.2. Everything else remained the same in the contract.

3.3   Contract choices and insurance take-up

This experiment studies the effect of offering a menu of contracts, rather than a single one, on farmers' insurance demand. The design is as follows (see Figure 1.3):

Pool of contracts:
1) (3.6, 200); 2) (7.2, 400); 3) (10.8, 600); 4) (12, 400); 5) (21.6, 600); 6) (15.6, 400); 7) (27.6,600)

Group T2: Choice set {1,2,3}. Contracts 2 and 3 are with the same per unit price as contract 1;
Group T3: Choice set {1,4,5}. This is what we provided in first round experiment, and contracts 4 and 5 are more expensive than contract 1;
Group T4: Choice set {1,6,7}. Contracts 6 and 7 are more expensive than contract 1, and also more expensive than contracts 2 and 3.

Figure 1.3 Design of insurance contract offers
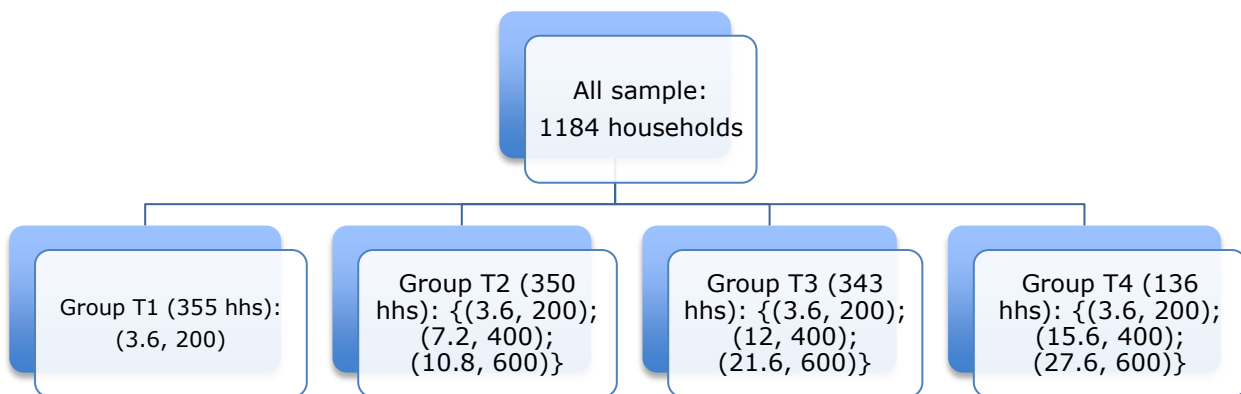
3.4 Baseline and follow-up surveys

The experimental sites of all projects in this study include 264 randomly selected villages in Jiangxi Province of China. In total, 7,680 households were surveyed in the baseline survey and 7,587 households were surveyed in the follow-up survey. The baseline survey consists of two components: a household survey and a social network survey. One year after the baseline, a follow-up survey was implemented. The follow-up survey data is from two sources: a household survey and administrative data from the Rural Credit Cooperatives (RCCs), the main rural bank of China.

Consider the baseline survey first. The household survey contains five parts: first, household characteristics including household size, age, and education of the household head, area of rice production, yields and sales, household income from different sources, borrowing, etc.; second, types of natural disasters experienced and loss rate in rice yield in the past three years, and methods of coping with such losses; third, experience in purchasing any kind of insurance and payouts received in the past three years; fourth, risk attitude and perception of future disasters;[14] fifth, questions which test the farmer's knowledge of how insurance works and what are its potential benefits, household's trust on the insurance company about the loss-checking and payout issuing process, and willingness to pay for the insurance. Summary statistics of selected variables are presented in Panel A of Table 1. Household heads are almost exclusively male, and their average education level is between primary and secondary school. Rice production is the main source of household income, which accounts for 73 per cent of total income on average. Most households have experienced some types of natural disasters in the most recent year, and the average loss rate was around 28 per cent. Households are on average risk averse, and they are more risk averse in the second year compared with the first year, which can be due to experience of weather shocks during the first year.

The social network component of the survey asked the household head to rank and list five close friends, either within or outside the village, with whom the respondent most frequently discusses rice production and financial related problems.[15] The relationship with each person named, topics that they usually talk about, and contact frequency were also elicited. The social network variable is defined as the fraction of friends with whom they have social links that were invited to a first round intensive session (where financial education was provided). According to Panel B in Table 1, the average number of friends listed by households is 4.9, which means that only a small proportion of households listed less than five friends. On average, households have 16 per cent friends named in the social network survey that been invited to the first round financial education provided in the intensive session.

Since how well and how fast information can be diffused between households may depend on network structure such as village size, positions of households in the

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[14]Risk attitudes were elicited by asking sample households to choose between increasing amounts of certain money (riskless option A) and risky gambles (risky option B). The number of riskless options was then used as a measure of risk aversion. The perceived probability of future disasters was elicited by asking: 'what do you think is the probability of a disaster that leads to more than 30 per cent loss in yield next year?'

[15] Respondents can list any people except for their parents and children, because in many cases, parents and children cultivate the same plots of rice together.

network, etc., we constructed several measures of village and household-level social network characteristics, and summary statistics of these variables are listed in Panel C of Table 1. We consider the following village-level network characteristics: network size, defined as the number of households in each village; segmentation of village network, measured by the fraction of 'giant component', which is the share of households in the graph that are in the largest connected component; and three indicators of interconnectivity: (i) graph clustering rate, defined as the fraction of pairs of household friends that are friends of each other; (ii) transitivity, defined as the fraction of transitive triads (A is linked to B, B is linked to C, and C is linked to A) in the total number of triads; and (iii) reciprocity, defined as the fraction of bilaterally linked pairs of households in the total number of household pairs. Average values across the sample villages are reported in Panel C of Table 1. Villages have on average 32 households. They essentially include only one large connected group, with almost 99 per cent of households in this main component. The average clustering rate shows that, in 18 per cent of the cases where household i is connected to some households j and k, j and k are connected to each other. As for the transitive and reciprocal indicators, 21 per cent of all possible household triads are connected to each other, and 17 per cent of all possible pairs are bilaterally connected. These three indicators project the image of a dense level of connectivity among households of a village.

One can also characterize the importance of a given household in a network. We retain three indicators for this: (i) in-degree, which is the number of persons that named it as friend; (ii) path length, which is the mean of the shortest paths to/from this household from/to any other household; and (iii) Eigenvector centrality, which measures a household's importance in the overall flow of information. This last indicator is a recursively-defined concept where each household's centrality is proportional to the sum of its neighbors' centrality. Average values for these variables are reported in Panel C. Each household is on average cited as a friend by three persons. The average path length is around 3.5, which means that a household can be connected to any others in the village by passing on average through three to four households. These relatively short average paths reflect the intensity of network links in these villages.

We conducted a follow-up survey one year after the insurance policy had been introduced. According to Panel E in Table 1, during the first year, around 56 per cent of households who purchased the rice insurance received some payouts, and the average amount of payout was around 86 RMB per mu. The area of rice production increased slightly, from 12.6 mu per household to 13.3 mu per household. The administrative data from the RCC provides us with households' borrowing and saving information. During the year after the insurance was provided, the average household saving is around 2,460 RMB,[16] which is equivalent to the production cost of 7 mu of rice. For those who borrowed from RCC (around 980 households), the average loan

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[16] The exchange rate between RMB and US dollar equals 6.3. The daily wage is around 40 RMB per day. The average loan size is much higher than the saving. There are two reasons for this. First, note that the size of saving in RCC is lower than the actual saving. For example, they may keep savings at home or save in other banks. We asked RCC to report the village-level share of saving in RCC and controlled for that in the analysis. Second, households may have other assets, which RCC will take into account when deciding on the loan ceiling.

size is 23,450 RMB, while the average repayment rate equals 70 per cent. Since the RCC is the only bank which provides microcredit in this area, there's no other formal borrowing.

Table 1 Summary statistics

Table 1. Summary Statistics

	Sample Mean	Sample Std. Dev
PANEL A: HOUSEHOLD CHARACTERISTICS		
Gender of Household Head (1 = Male, 0 = Female)	0.914	0.280
Age	51.494	12.032
Household Size	4.915	2.133
Education (0 = illiteracy, 1 = primary, 2 = secondary, 3 = high school, 4 = college)	1.192	0.853
Area of Rice Production (mu, 1 mu = 1/15 hectare)	12.635	19.921
Share of Rice Income in Total Income (%)	73.258	34.841
Any Disasters Happened Last Year (1 = Yes, 0 = No)	0.631	0.483
Loss in Yield Last Year (%)	27.507	18.199
Baseline Risk Aversion (0-1, 0 as risk loving and 1 as risk averse)	0.711	0.313
Baseline Perceived Probability of Future Disasters (%)	33.633	16.619
Follow-up Risk Aversion (0-1, 0 as risk loving and 1 as risk averse)	0.849	0.284
Follow-up Perceived Probability of Future Disasters (%)	27.081	22.133
PANEL B: SOCIAL NETWORK FINANCIAL EDUCATION MEASURES		
Number of Friends Listed	4.893	0.510
General Measure: %Friends Attending 1st Round Financial Education	0.161	0.189
Strong Measure: %Mutually Listed Friends Attending 1st Round Financial Education	0.043	0.100
Weak Measure: %2nd order Friends Attending 1st Round Financial Education	0.154	0.114
PANEL C: SOCIAL NETWORK STRUCTURAL CHARACTERISTICS		
Village Size (Number of households)	31.962	9.839
Graph Clustering (Village level)	0.182	0.085
Fraction in Giant Component (Village level)	0.987	0.070
Transtivity (Village level)	0.213	0.067
Reciprocity (Village level)	0.168	0.054
In-Degree (Household level)	3.266	2.496
Path Length (Household level)	3.578	1.941
Eigenvector Centrality (Household level)	0.148	0.098
PANEL D: BASELINE INSURANCE TAKE-UP		
Insurance Take-up Rate (%), all sample	43.941	49.637
Insurance Take-up Rate (%), 1st round simple session	35.218	47.787
Insurance Take-up Rate (%), 1st round intensive session	50.365	50.021
Insurance Take-up Rate (%), 2nd round simple session	44.394	49.722
Insurance Take-up Rate (%), 2nd round intensive session	44.292	49.711
PANEL E: FOLLOW-UP OUTCOME VARIABLES		
Payout Rate Among First Year Buyers (%)	43.941	49.637
Amount of Payout Among First Year Buyers (RMB, per mu)	49.921	50.013
Rice Production Area (mu)	13.31	19.74
Saving (Rmb)	2464.46	10752.66
Average Loan Size (Rmb)	23450.66	29925.39
Repayment ([0,1])	0.6966	0.3893
Number of villages: 264		
Number of Households: 7587		

4. Results

4.1 Financial education, social networks, and the decision to insure

We investigate the value of financial education and social networks for insurance take-up using the experimental design reported in February 2011, and summarized in Figure 1.1 above. According to the following table, financial education improves take-up by around 15 percentage points, from 35 per cent to 50 per cent.[17]

As shown in Figure 2, we find a large and positive spillover effect of financial education: for second-round participants, having one additional friend who obtained first round financial education increases take-up by half as much as the effect of receiving financial education directly. We use a household-level price randomization to show that this effect is equivalent to decreasing the average insurance premium by 12 per cent.

Table 2.1 Effect of financial education on insurance take-up

VARIABLES	Insurance Take-up (1 = Yes, 0 = No)	
	(1)	(2)
Intensive Financial Education Session	0.149***	0.140***
(1 = Yes, 0 = No)	(0.0261)	(0.0259)
Male		0.0393
		(0.0476)
Age		0.00205*
		(0.00108)
Household Size		-0.00381
		(0.00514)
Rice Production Area (mu)		0.00161
		(0.000993)
Literate (1 = Yes, 0 = No)		0.0823***
		(0.0269)
Village Fixed Effects	Yes	Yes
R-Squared	0.121	0.129

Notes: Robust clustered standard errors in parentheses. The estimation is based on the sample of participants in the two first-round sessions (T1, T2). *** $p<0.01$, ** $p<0.05$, * $p<0.1$

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[17] The per capita cost of financial education equals around 15 RMB. The session participation rate is around 88 per cent.

Figure 2 Effect of having friends attending financial education on insurance demand
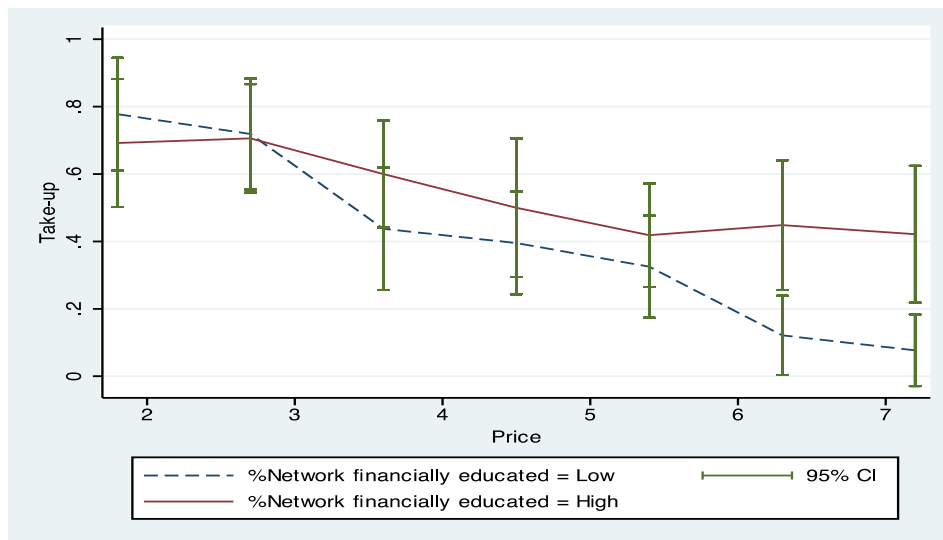
Note: The variable % Network financially educated is defined as 'high' if it is above the sample median and is defined as 'low' if it is below the sample median.

After observing a large and significant effect of social networks, it is natural to ask: what information conveyed by social networks drives this large effect? Do social networks matter in insurance adoption because they can diffuse knowledge among farmers about the product benefits? Or is it because farmers learn about each other's purchase decisions and make their own decisions based on that? While distinguishing different mechanisms through which social networks operate is crucial from both theoretical and policy perspectives, only a few studies to date have shed light on this point. We find that there is something special about social networks in rural communities: they do not convey information about what other people do, even though others would like to obtain such information, but they do effectively convey information about what other people know. As a result, the main mechanism that drives the social network effect is social learning about insurance benefits, as opposed to imitation. This result is reached in the following way:

- To identify the insurance knowledge mechanism, we compare the effect of financial education on insurance take-up and knowledge between the two rounds (groups T1 vs. T2, and groups U1 vs. U4 in Figure 1.1). The effect of financial education is shown in Figure 3 by the difference between the first and second bars for the first round and between the third and fourth bars for the second round. The left hand side panel shows that the effect of financial education on uptake is smaller in the second round than in the first round. The right hand size panel suggests that farmers understand insurance benefits better when they have a greater number of friends who received financial education. This means that there was diffusion of knowledge from first round to second round participants.

- To identify the purchase decision mechanism, we exploit the exogenous variation in both the overall and individual take-up decisions generated by randomized default options to estimate whether or not subjects are affected by their peers' decisions. We then compare the uptake in groups U1 and U4 shown in Figure 1.1, who did not receive different level of information on their peers' uptake. This peer uptake varies form 0 per cent to 100 per cent over the sample. Results in Column (4) of Table 2.2 show that surprisingly, no significant effect was found. However, when we told farmers about other villagers' decisions (U3 and U6), we find that other people's decisions actually mattered a lot to them (Column (5), Table 2.2).

Figure 3 Average take-up rate (left) and insurance knowledge (right) in different sessions
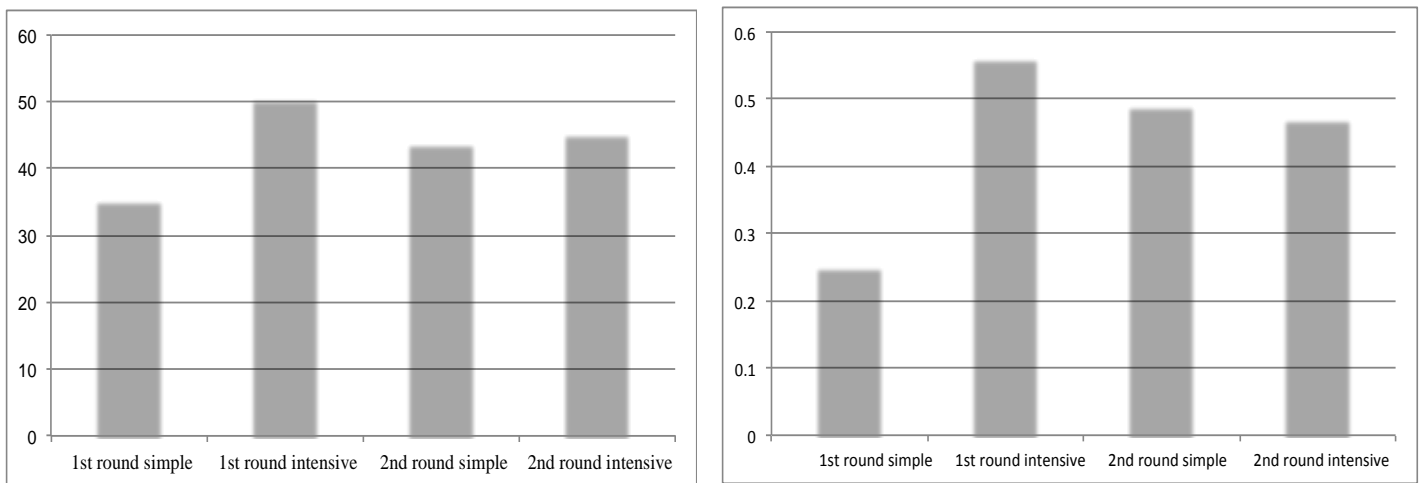
Table 2.2 Effect of friends' decisions in 1st round sessions on 2nd round take-up

	Network 1st Round Take-up Rate	2nd Round Insurance Take-up (1 = Yes, 0 = No)			
Sample:	U1U3 U4 U6	U1 U3 U4 U6		No Information Revealed (U1 U4)	Revealed 1st Round Overall Take-up (U3 U6)
		OLS	IV	IV	IV
VARIABLES	(1)	(2)	(3)	(4)	(5)
1st Round Overall Take-up Rate		0.610***	0.436	0.0225	0.691
		(0.108)	(0.602)	(1.452)	(0.664)
1st Round Network's Take-up Rate		-0.0174	0.555**	-0.0891	0.589**
		(0.0528)	(0.274)	(1.456)	(0.280)
No Information Revealed		0.261***	0.412**		
(1 =Yes, 0 = No)		(0.0555)	(0.194)		
1st Round Overall Take-up Rate		-0.545***	-0.723		
* No Information Revealed		(0.123)	(1.181)		
1st Round Network's Take-up Rate		0.0169	-0.0950		
* No Information Revealed		(0.0730)	(1.030)		
Default	0.308***				
* Network in 1st Round Sessions	(0.0593)				
No. of Observation	1,643	1,643	1,643	983	660
Village Fixed Effects	Yes	Yes	Yes	Yes	Yes
Household Characteristics	Yes	Yes	Yes	Yes	Yes
R-Squared	0.163	0.089		0.074	
P-value of Joint-significance:					
1st Round Overall Take-up Rate		0.0000***	0.7072		
1st Round Network's Take-up Rate		0.9466	0.1248		

Notes: Robust standard errors clustered at the village level in parentheses. Columns (1) - (3) are based on second round participants that received either no information or the decision list of first round sessions from us (U1, U3, U4 and U6 in Figure 1.1) . Column (4) is based on the sub-sample with no additional information (U1 and U4 in Figure 1.1), while column (5) is based on households to whom we provided the decision list of first round participants (U3 and U6 in Figure 1.1). In IV estimations, the default option and %friends in the 1st round*default are used as instruments for the first round overall take-up rate and network's take-up rate, respectively. For IV estimation in Column (3), the F-statistics for the excluded instruments equals 26.88, which is well above the conventional weak instrument threshold of 10. *** p<0.01, ** p<0.05, * p<0.1

We followed up one year later with a subsample of households from the first year experiment to study the effect of social networks over time. The randomization in year two included a household-level insurance price. We find that households are not influenced by their friends' purchase behavior during the previous year. However, observing an above median share of friends receiving payouts increases second year take-up at all price levels (by 21.7 percentage points on average) and makes people less sensitive to price change (offsets the price effect by more than 50 per cent). The effect is equivalent to reducing the average insurance premium by 35 per cent, and is as effective as about 54 per cent of the impact of receiving an actual payout. This means that social networks affect insurance take-up over time through social learning about friends' experience with payouts.

Figure 4 Effect of observing friends receiving payouts on second year insurance demand
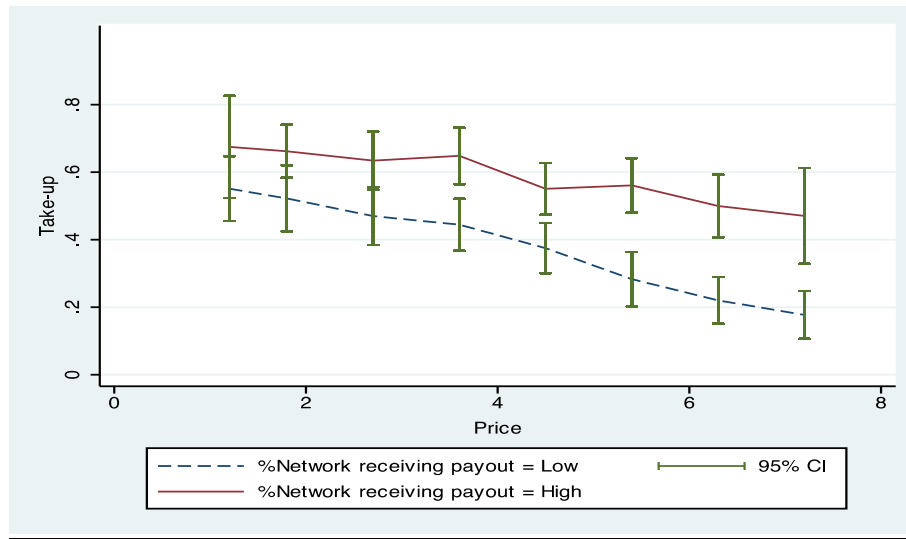
Notes: The variable % Network receiving payout is defined as "high" if it is above the sample median and is defined as "low" if it is below the sample median.

This analysis of the role of networks in influencing insurance uptake is fully developed in Cai *et al*. (2013).

4.2 Short-run subsidy policies and long-run insurance take-up

The following results are reported as preliminary. Detailed figures and tables results will be available when the corresponding papers are posted and/or published.

To analyze the role of short- and long-term subsidies on insurance take-up, we compare the second year demand curves under different subsidy policies. We find that the overall second year take-up rate among households under full subsidy policy in the first year is slightly higher, but the effect is not significant. Moreover, price sensitivity does not look different. In order to explain why, we test three features: the effect of having access to insurance, price anchoring, and a learning effect.

Regarding the first effect, we find that more households uptake the insurance under full subsidy policy. If having the insurance for one year can raise people's valuation of it and remove uncertainty about it, then a first year full subsidy should be associated with better second year adoption. However, we find that having access to the insurance does not influence either the level or the slope of the demand curve in the following year. This means that using subsidies to simply enlarge the coverage rate is not enough.

Regarding the second, we did not find a price anchoring effect.

Finally, regarding the third, we explore whether the learning effect is different between the two subsidy policies. We find three main results: First, for households who paid for the insurance in the first year, receiving payouts had a positive level effect on second year demand, and households are less sensitive to a price increase if they received payout. However, for households who received it for free, although

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receiving payouts has a positive effect on second year take-up, there is no significant effect on the slope of the demand curve, and the level effect of receiving a payout is much higher under the partial subsidy policy.

Second, we see similar patterns in the case of observing payouts. Under the cost-sharing subsidy policy, observing friends receiving payouts improves second year take-up at all price levels and makes people less sensitive to price changes for households who did not purchase insurance in the first year. However, there is no such effect for households who purchased insurance in the first year, regardless of whether they received payout by themselves or not.

Third, the full subsidy policy, observing friends receiving payouts does not have slope effects. It only has a significant level impact on second year demand curve for households which did not want to purchase insurance at 3.6 RMB in the first year and which did not receive payout, and the magnitude of the effect is smaller than that in the non-free sample.

4.3 Contract choice and insurance take-up

Comparing groups T1, T3, and T4, we find that while offering more contract choices can raise the overall take-up rate (purchase of any contract) significantly (from 30 per cent to 50 per cent), it is mainly driven by increase of the basic contract take-up (from 30 per cent to 42 per cent). However, this effect disappeared if the per unit price of the three contracts are the same: Indeed in that case (T2 compared to T1), all contracts secure substantial demand and the basic contract decreases.

4.4 Impact of insurance provision on production, saving, and borrowing

The impact evaluation of insurance provision on household behaviors is made challenging by the endogeneity of insurance purchase decisions. We take advantage of exogenous variation in baseline insurance take-up generated by the financial education treatment to identify the causal effect of insurance provision on households' production, saving, and borrowing. The estimated effect is a local average treatment effect (LATE), in the sense that it gives the impact on the population which is induced to uptake the insurance as a consequence of the selected instruments (financial education or default option).

Note that while we surveyed around 7,600 households, not all of them have savings and borrowing information. Specifically, 7,480 of them have saving accounts at RCC and only around 900 of them have borrowed from the bank.

We find that financial education influences take-up significantly, and as a result can serve as a valid instrumental variable (IV) for baseline insurance take-up. The IV result suggests that households produce more rice after they purchased insurance; however, the effect is not statistically significant.

We also analyzed the effect of insurance provision on saving and borrowing. Based on the IV estimation result, we find a non-statistically significant effect on saving, although the point estimate is large at 776 RMB indicating an increase in savings by more than 30 per cent of the base value. Households increased borrowing by 5.5 per

cent of their base level of borrowing and were more likely to repay the loan (with a very large increase of 16.6 percentage points) after insurance was purchased. However, again, these effects are not statistically significant.

We also look at the spillover effect of insurance purchase from friends. In other words, if more of your friends purchased insurance, will your behavior be influenced? To identify the causal spillover effect, friends' baseline insurance take-up rate is instrumented by the baseline financial education treatment and the randomized default options. We find that these two IVs are important determinants of friends' take-up rate. There is however no significant spillover effect on rice production.

We also found no significant spillover effect on saving and borrowing.

4.5   Interpretation and discussion of impacts

In this section we provide a framework for understanding and interpreting the findings on the impact of insurance on farmers' behavior and welfare.

The basic theory developed in Besley (1995) shows that households that face risky incomes will use savings and credit to attempt to smooth their consumption. If the capital market were perfect, meaning that the same interest rate prevailed for deposit and for borrowing, and that there were no credit constraints, households would save whenever their resources (income plus available savings) are higher than their permanent income, and borrow whenever their available resources are lower than their permanent income. If one adds transaction cost in the form of differential interest rates, households save and borrow less than the perfect market solution, and hence absorb some risk in their consumption. If one adds a constraint to the maximum amount a household can borrow, households will save more in order to mitigate the potential of facing a constraint in the future. This is a form of precautionary savings. Introducing an insurance that reduces income risk is thus expected to reduce households' optimal saving and credit behavior. This is what we understand is the context in which our experiment takes place. Indeed, in China in general, and in these villages in particular, the savings rate is extremely high, and this is well understood to be as precautionary savings in a world with little social protection.

That said, while the optimal savings rate should decrease in expected value, it does not mean that savings will every year be smaller than they would be without an insurance contract. In particular, after a shock, households that are insured and received a payout have more resources than households that are not insured. Hence, in the short term, their savings may be higher. What would be a good test of the theory would be to see that households maintain on average a lower balance, especially after good years, since they do not have to keep as much precautionary savings. This of course cannot be done over a two-year experiment.

The credit side of the story in this pure consumption smoothing model comes from the fact that the supply of credit is likely to increase with insurance, as lenders are

more willing to lend to insured farmers. Following model predictions, this should reduce savings and increase the uptake of credit.

A separate effect of insurance is to reduce the actual riskiness of rice production, and hence in a standard portfolio of activities, induce an increase in investment in rice production, either by extending the area planted or by intensifying production with use of more inputs. Here again, the availability of credit will further increase this behavioral response to decreased exposure to risk.

A third benefit of insurance in a year with large losses is that payouts give resources to producers, facilitating reinvestment in production.

All these channels necessarily jointly take place, and hence cannot be distinguished with only one year of observation. The net predictions for this one year are thus indeterminate for savings and credit, and for an increase in production. Since most of our results are not statistically significant, we only have suggestive evidence on the short-run impact of insurance on household savings and borrowing: we indeed find a relatively large increase in area in rice production, by 4.7 mu over a baseline average of 12.6. It is quite remarkable that producers responded so rapidly.We also find an important increase in loan repayment, and in savings, although both of them are imprecisely measured.

Finally, in terms of welfare, the most obvious effect is the benefit of receiving a payout in a year of high losses. This is what happened to 43 per cent of those who purchased the insurance in our year of observation. The short-term cost of the premium represents a welfare loss but is small. The insurance gives a net transfer of $1.5 (9.28 RMB/mu) per mu/capita to the 43 per cent of the insured that received payout and a net loss of $0.12 per mu/capita for the 57 per cent that did not incur a loss. Over the long run, the expected net transfer from a subsidized insurance is positive, equal to the subsidy rate. This is obviously a source of welfare gains, all the more so that the payouts also reduce the volatility of income. Further welfare gains may occur when the behavioral responses to reduced risk discussed above induce welfare improving decisions.

5. Policy recommendations

It is very early to derive policy recommendations based on a two-year study of the introduction of a brand new financial product that is difficult to understand. However, it is clear that, first, social networks are important in helping people understand and adopt this new product, and hence the insurance company should continue to share the information on people's decisions to insure and on payouts distributed. Second, making sure that people understand the product is critical and worth several points of subsidies. Offering financial training to producers is thus important for uptake. Third, offering multiple contracts rather than a single one is a very cost-effective marketing tool. Fourth, in so far as the government is willing to subsidize the insurance, this is definitely welfare enhancing for farmers. Two years is too short to see how farmers will adjust their production, savings, and borrowing behavior. However, there is some suggestive evidence that they do respond by increasing investment in production, a

very encouraging result. Based on these findings, the program has been scaled up by PICC to reach more provinces in 2012.

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The provision of weather insurance is a potential way of shielding farmers from weather related shocks and reducing poverty. However, the use of weather insurance is not widespread in many countries. In China, even with a government subsidy of 70 per cent, the take-up of weather insurance is quite low.

This evaluation looked at the impact of financial education, social learning and contract design on the take-up of a new weather insurance product in China. The study found that financial education about insurance increases take-up from 35 per cent to 50 per cent. There were large spillover effects of financial education: farmers who had more friends exposed to financial training performed significantly better on an insurance knowledge test. The study also found that offering a menu of insurance contracts rather than a single contract increased take-up dramatically.

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