Risk, Credit, and Insurance in Peru: Field Experimental Evidence

Francisco Galarza

University of Wisconsin-Madison

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Francisco B. Galarza†
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Abstract

This paper reports the results of behavioral economic experiments conducted in Peru to examine the relationship amongst risk preferences, loan take-up, and insurance purchase decisions. This area-based yield insurance can help reduce people's vulnerability to large scale covariate shocks, and can also lower the loan default probability under extreme negative covariate shocks. In a context of collateralized formal credit markets, we provide suggestive evidence that insurance may help reduce the fear of losing collateral that prevents potential borrowers from taking loans. Framing these experiments to recreate a real life situation, we started with a *Baseline Game* where subjects had to choose between a fallback production project and an uninsured loan.We then introduced a third project choice—loan with yield insurance (*Insurance Game*)—which allows us to measure the effect of introducing insurance on the demand for loans. Overall, more than 50 percent of the subjects are willing to buy insurance in this insurance game. Further, controling for choices made in the baseline game, covariate shocks experienced earlier, and previous rounds' winnings, we find that the decision to take the insured loan (uninsured loan) rather than any of the other two projects is predicted by wealth and lower (higher) levels of risk aversion. Interestingly, this relationship with risk aversion continues to hold when we control for the overweighting of low-probability events observed in the data.

Keywords: area-yield insurance, credit, covariate risk, idiosyncratic risk, risk aversion, probability weighting, experimental economics, Peru.

JEL classification numbers: C93, D10, D81, 012, Q12.

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†Department of Agricultural and Applied Economics. E-mail: `fbgalarzaare@wisc.edu`.

1 Introduction

Risk is widespread in less developed economies, where low-income people from rural areas are exposed to several potentially catastrophic hazards, such as severe weather events, in addition to a series of idiosyncratic shocks that periodically affect them. In order to manage and deal with risk, those people have used a series of *ex-ante* and *ex-post* strategies[1] over a long time with less than desired results. Indeed, recent evidence suggests that, despite the substantial efforts to reduce their vulnerability to negative economic shocks, consumption variability at the individual level still remains high in the developing world (Dercon, 2005; Morduch, 1995). Depending on the nature and magnitude of those shocks, this lack of appropriate equipment may lead people to chronic poverty, thus affecting their possibilities to engage in an economically viable growth path.[2]

In addition to individual specific efforts displayed to handle risk, innovative financial products, such as microloans and index-based insurance, have been designed and implemented from the supply side, in order to reduce low-income people's vulnerability to extreme economic shocks. On the one hand, in the wake of the so-called microfinance revolution, poor people, typically unable to offer collateral, have become eligible to get credit access and take advantage of business opportunities, while on the other hand insurance written on average aggregate indices has emerged with the promise to help households keep valuable assets which could otherwise be lost as a result of extreme negative shocks.

But, even though some formal lenders may relax their collateral requirements to grant loans, potential borrowers may still decide to withdraw from the credit market because they fear losing collateral in case of default.[3] In such a context, index-based insurance that protects producers from large covariate shocks and reduces the likelihood of loan default, could contribute to expand credit markets, by reducing the proportion of risk rationed producers.

To which extent insurance can help expand credit markets in less developed countries is an empirical question that has not sufficiently been investigated. With only a few index-based insurance programs operating in less developed countries, the literature on the credit-index insurance linkage is at best scant. With the exceptions of Cole et al. (2008), who studied the obstacles to a wider insurance take up in India, Giné and Yang (2009), who analyzed whether rainfall insurance can help increase demand for loans in a randomized control trial in Malawi, Giné et al. (2009), who designed experiments in urban Peru to test the demand for different microfinance contracts in urban Peru, and Lybbert (2006), who designed experiments in Morocco to elicit willingness to pay for seeds that increase yields, reduce yields variance or yields skewness, to our knowledge no other work has addressed, directly or indirectly, the issues that concern this paper.

This paper uses a unique experimental data set gathered in rural Peru, where we set up an

[1]Risk management, *ex-ante* strategies, may include income diversification, savings, insurance, participation in rotating saving and credit associations (ROSCAs); while risk coping, *ex-post* strategies, may include the use of informal loans, liquidation of assets, and reallocation of labor, among others.

[2]The literature on poverty has documented this case, in which when households fall below certain threshold—the Micawber Frontier—their prospects to escape from poverty are negligible (Carter and Barrett, 2006).

[3]The magnitude of this withdrawal from credit markets, a result coined *risk rationing*, is empirically relevant in Peru, Honduras, and Nicaragua, where risk rationed borrowers account for between 12-19 percent of the total sample of borrowers (Boucher et al., 2008)

experimental economics laboratory and run games to examine the nature and main predictors of the demand for loans and index-based insurance (we label these behavioral experiments "farming games"[4]); in particular, we examine the effect of risk preferences, estimated in Galarza (2009), on the decision to purchase insurance. These experimental sessions were conducted with the same set of subjects as the risk experiment. This research project was carried out in partnership with an insurance company in Peru and a vendor of insurance contracts bundled with loans in our research site (the Pisco valley). In our sessions, we emphasized the fact that our participation as researchers was simply intended to inform farmers about the main features of this new financial product and to examine their willingness to buy it. We also stressed the fact that participating in these sessions should not make them feel obliged to buy insurance. Our farming games simulated farming decisions where our experimental subjects had to choose among alternative cotton production projects: fallback (low return, or *safe*), produce with an uninsured loan (high return, or *risky*), or produce with an insured loan (loan bundled with insurance, *less risky*). Project choices were made after knowing the profits associated with each project, at particular realizations of two random variables: a covariate shock (represented by the valley-wide average yield), and an idiosyncratic shock.

The behavioral experiments started with a *baseline game*, where farmers had to choose between the first two production projects—fallback and uninsured loan—in a series of repeated rounds. Using survey data from the Pisco valley, the uninsured loan project was designed so that under a very low realization of the valley-wide average yield, repayment is not possible regardless of the realization of the idiosyncratic shock. In these games, by construction, not repaying a loan has two consequences: no future loans are granted, and the land depreciates.[5] After running the baseline game, we introduced the third production project (insured loan). This new, *insurance game* allows us to test whether this new project affects farmers' choice between the safe and the risky project. Since this insured loan project guarantees full repayment of loans at every realization of the covariate and idiosyncratic shocks, we could expect that producers having fear of defaulting in the baseline game (i.e., those risk rationed[6]) would be more likely to select the insured loan when it is available. And that is precisely what we found, as we report below.

Our sample includes 378 experimental subjects from rural Peru.[7] Surveys conducted with our subjects provided information about the prior knowledge of insurance, willingness to pay for insurance at several premium levels, and *ex-post* measures of learning about the main features of the uninsured and insured loans. The analysis performed in this paper considers the choices made in the last round where a farmer had a chance to *learn* during the high stakes rounds, which could be the last high-stake round (if no loan default happened) or that immediately before the one in

[4]The terms "experiments" and "games" are used interchangeably throughtout the text.

[5]This consequence is intended to replicate the penalty that a defaulting borrower would face in terms of having seized his or her land.

[6]Following Boucher et al. (2008), we consider *risk rationed* to be those subjects who chose to do the safe, fallback project instead of the uninsured loan project during the baseline game, as we assume they did so because they did not want to run the dynamic risk that implies defaulting on a loan.

[7]We had originally 409 subjects showing up to the experiments, 385 of them completed all the activities in the experimental sessions, and we have most of the individual specific information for 378 of them.

which a subject defaulted a loan.

Our findings are as follows. First, the experimentally-measured demand for valley-wide average yield insurance is fairly high: 57 percent of farmers demanded the insured loan project by the last two high-stake rounds, a proportion that remains rather steady during all the high stakes rounds. Second, experimental evidence suggests that index yield insurance, by reducing the likelihood of loan defaults, may crowd-in credit markets by a sizeable proportion. We find that 57 percent of the subjects who chose the fallback, safe project (i.e., 24 percent of the total subjects) in the baseline game switched to the insured loan project during the insurance game. This result suggests that insurance would allow almost 14 percent of the total number of subjects not to withdraw from the credit market.[8] While it is clear that such estimated magnitude may not be accurate, it is suggestive that insurance could encourage the undertaking of riskier but potentially more profitable production projects thanks to new funds coming from a loan.

Third, in regards to the predictors of insurance (or the insured loan) "purchase" in the insurance game, controlling for choices made in the baseline game and a source of judgment bias, we find that wealth appears correlated with a greater likelihood of choosing the insured loan, while static risk preferences estimated assuming a Constant Relative Risk Aversion utility function under Expected Utility Theory and Cumulative Prospect Theory—which adds a parameter measuring subjective distortions to actual probabilities—enter the regression with a negative coefficient. We argue that this seemingly counterintuitive result may be explained by the fact that higher risk averse subjects are found to be significantly *less* likely to have understood the intertemporal and dynamic benefits of insurance, thus being *less* likely to choose the insured loan. This result offers novel evidence about the relationship between risk aversion and preferences for innovative financial instruments.

With the emergence of field experiments as a tool increasingly used in development economics,[9] a great deal of studies have been carried out with the aim to examine the impact of policy interventions on people's well-being. However, unlike randomized control trials, which analyze the effects of an intervention by comparing a randomly assigned treatment group with a similarly random control group, a relatively small number of behavioral experiments use a payoffs structure to incentivize subjects to reveal their true preferences. This paper analyzes the results of an experiment of the latter type, an approach that appeals to us as being an effective tool to build people's comprehension of a new financial product and subsequently measure their willingness to buy it. We thus see this paper as contributing a novel methodology to experimentally examine the relationship between the decision to take a loan, to purchase insurance, and risk preferences.

The remainder of this paper is organized as follows. Section 2 discusses our experimental design in the context of related works. Section 3 describes the experimental procedures followed and the data used; and also presents a descriptive analysis of the results. Section 4 analyzes the main econometric results and Section 5 concludes.

[8]After this round in default, farmers are left with no choice but to do the fallback project. The quantitative importance of this finding increases to about 20 percent when we use the *modal* choice during the high-stake rounds.

[9]This is particularly true in the case of randomized control trials. Banerjee and Duflo (2008) conduct a thorough review of the main advantages and criticisms of these methods used in economics.

2 Related Studies and Our Experimental Design

In this section, we review the related literature (section 2.1) and then discuss the distinctive features of our experimental design in that context (section 2.2). Using the terminology coined by Harrison and List (2004), our farming games are *framed* field experiments, as they concern valuations over a real commodity (cotton) and involve tasks similar to those performed by the experimental subjects in real life.

2.1 Related Studies

Although in recent years field experiments in development have analyzed a wide gamut of topics, there still remains much to do in terms of applying the laboratory experimental tools to analyze development issues. In a survey of the literature about experiments conducted in developing countries, Cardenas and Carpenter (2005) report that three of the main topics studied are the measurement of trust, cooperation, and risk. More recent behavioral field experiments have involved testing the demand for microfinance contracts (Giné et al., 2009) and the willingness to pay for seeds that stabilize yield distributions (Lybbert, 2006), in both cases using hypothetical payoffs. Finally, we report two randomized control trials that examine the demand for weather-based insurance in India and Malawi, respectively (Cole et al., 2008; Giné and Yang, 2009).

Lybbert (2006) uses a payoffs structure in order to incentivize farmers in India to elicit their preferences about three desirable properties of cotton seeds: an increase in yields, a reduction in yields variance, and a reduction in yields skewness. Using the Becker-DeGroot-Marchak method (Becker et al., 1964) to elicit the maximum willingness to pay for those traits, where farmers were given the payoff distributions related to each type of seed before making their bid,[10] the study shows that farmers value seeds that increase the expected returns, but no evidence was found about their valuation of the other two traits of seeds. As Lybbert acknowledges, the lack of valuation of yield risk reduction (i.e., less variance) may be explained by the inability of the experimental design to control for the relevant factors that affect farmer's valuation of crop yield distributions. Lybbert's results further show no statistically strong relationship between any individual characteristic (such as wealth) and expected returns, a result that Lybbert claims could be due to the existence of credit constraints.

In a randomized control trial in Malawi, Giné and Yang (2009) investigate whether insurance can induce farmers to take loans to adopt a new, high-yielding seed variety. The control group of subjects was offered a loan to purchase a high-yielding seed; while the treatment group was offered an identical loan contract and was *required* to buy actuarially fair rainfall-indexed insurance *if* they took the loan. This insurance can allow them to partially or fully repay the loan, depending on how low the rainfall is. Thus while assuming a risk averse behavior, one could expect insured farmers to

[10] Once farmers bid a price, a random seed price was drawn from a uniform distribution with mean of 50 Rupees (Rs.). Thus, if farmers bid at least the amount of the randomly drawn price, they could get the seed and "plant it", and get the corresponding payoff. After this, farmers draw a chip from a bag to determine the season's harvest payoff. Thus, for a farmer who planted the seed, his net earnings would be the harvest payoff, minus the price paid for the seed, plus 50 Rs. (off-farm earnings), while for one who did not plant the seed, it would be only the 50 Rs. corresponding to the off-farm earnings.

be more willing to take out a loan in order to undertake a potentially more profitable investment (buying the high-yielding seed), Giné and Yang find exactly the opposite result: loan take-up rates are much lower for the treatment group (17.6 percent *versus* 33.0 percent). These authors suggest that the low insured loan take-up could be due to the prior existence of limited liability; that is, the actual consequences of defaulting on a loan might not have been so severe in the first place, and thus the actual value of buying insurance would be reduced. In the same vein, Cole et al.'s (2008) randomized control trials in two Indian States aim to identify the barriers to a wider adoption of rainfall insurance. They find that subjects' purchase rates are very price elastic, and that cash constraints seem to play a role in insurance adoption. More interestingly, they find that third party endorsement (such as that of a local authority) of insurance can affect its take-up.

Our behavioral experiment shares some features in common with the previously discussed works, but it arguably offers a more complete picture of how rural producers take decisions in real life. In particular, our experiment focuses on examining the interrelationship among three themes: agricultural yields, loan, and insurance. In our farming games, loans allow to get higher expected yields (i.e., a more profitable production), and insurance eliminates the possibility of defaulting a loan, thus securing the farm production and ensuring farmers to keep the option of requesting loans in the future. Written on valley-wide yields, this insurance protects producers from catastrophic events that dramatically reduce average yields at the valley level. Subjects' farming profits depend on two random variables: a covariate shock—represented by the valley-wide average yield—that affects equally all subjects in the same valley, and an idiosyncratic shock, uncorrelated with the covariate shock.

Moreover, while our farming experiments are close in spirit to the randomized control trials conducted by Giné and Yang (2009), we used actual payoffs to incentivize players to elicit their preferences for distinct production projects. Moreover, our farming games have greater complexity than the games of Lybbert (2006) in that our farmers' payoffs for each project choice depend on two sources of randomness, while in Lybbert's games there is only a random "yield risk" that subjects should consider before deciding their choice (a seed). Likewise, our farming games introduce additional complexity to the typical individual loan games, in which players have to choose whether to request a loan with a risky result, or to invest in a safe project (e.g., Giné et al., 2009), by providing subjects a more complete set of financial instruments to finance their production. Obviously, the greater complexity in the design of our games increases the challenges for ensuring experimental control. In the next section, we discuss the experimental design of our games.

2.2 Our Farming Games

The game script for our farming games was written following standard experimental procedures as close as possible (Davis and Holt, 1993). Game trials were conducted in Madison and Davis in the U.S. (with graduate students), and Lima (with social scientists and cotton farmers), and the valley of Pisco and its neighbor Ica (with cotton farmers), in Peru. The final version of the script was reviewed by a journalist who works closely with farmers, in order to ensure that the language used in the instructions would be understandable to a typical farmer.

The farming games were designed to estimate the potential demand for index-based crop insurance and examine the effects of using insurance on the demand for loans. In these games, we simulated farming decisions where subjects, endowed with a "hectare of land", had to choose among alternative cotton production projects—fallback (safe project), take an uninsured loan (risky project), and take a loan bundled with index yield insurance (insured loan, less risky project)[11]—in a series of repeated rounds.

Each project yields a related profit, which is known to subjects before they make their decisions. In the cases of the uninsured loan and insured loan projects, profits depend additively on the realization of two random variables: a covariate shock (represented by the valley-wide average yield), and an idiosyncratic shock. The probability distributions of both shocks were estimated using information from the Pisco valley. In particular, detrended 1986-2006 time series data of valley yields (y_t), expressed in Kilograms per hectare, were fitted to a *Weibull* density function; the parameters of the *Weibull* function were estimated using maximum likelihood in `Gauss`:[12]

$$y_t \sim \textit{Weibull}\ (6.00,\ 1806.08). \tag{1}$$

The distribution of valley yields has a mean of 1,674 Kilograms per hectare. In turn, four-year (2002-2005) panel data were used to estimate the distribution of the idiosyncratic shocks (ϵ_{it}),[13] using the following fixed effects model:

$$y_{it} - \mu_i = \beta_i(\overline{y}_t - \mu) + \epsilon_{it}, \tag{2}$$

which regresses the farmer i's yields (y_i) deviation from its mean, μ_i, on the deviation of the *sample*'s average yields ($\overline{y}_t$) from its mean (μ).

We then discretized the densities of valley yields, y_t[14] (*Weibull*), and idiosyncratic shocks, ϵ_{it} (*Normal* centered on zero), in order to simulate the effects of distinct realizations of those shocks on profits. In particular, we divided the density of y_t into five sections—labeled as *very low*, *low*, *normal*, *high*, *very high*—with the following probabilities (in percent): 10, 20, 40, 20, and 10. After the estimations above, we converted all yield figures to *quintals* (QQ)[15] (1 quintal = 46 Kilograms), a denomination familiar to our subjects. Thus, the valley yield values, y_t, corresponding to the mid-point of those sections are (in rounded figures): 23, 30, 37, 43, and 48 quintals per hectare, respectively. Analogously, the density of ϵ_{it} was divided into three sections—labeled as *bad*, *normal*,[16] and *good*—with the following probabilities: 25, 50, and 25. Thus, the deviations from the "normal" category are expressed as $\Delta\epsilon_{it}$. In particular, the mid-point of the "bad" luck

[11] Throughout the paper we use interchangeably the terms *fallback*, and *safe* project; the terms *unisured loan* and *risky* project, and the terms *insured loan* and *loan bundled with yield insurance* project.

[12] We used the Broyden–Fletcher–Goldfarb–Shanno (BFGS) algorithm. The parameters' standard deviations are 1.03 and 70.17.

[13] This is also a measure of the uninsured or basis risk uncovered.by insurance.

[14] Note that y represents the *valley* average yield, while $\overline{y}$ refers to the *sample* average used to estimate the idiosyncratic shocks.

[15] A *Quintal* is equivalent to 100 pounds, which is in turn roughly equivalent to 46 Kilograms.

[16] The "Normal" categories of those shocks lie roughly at the center of their respective densities.

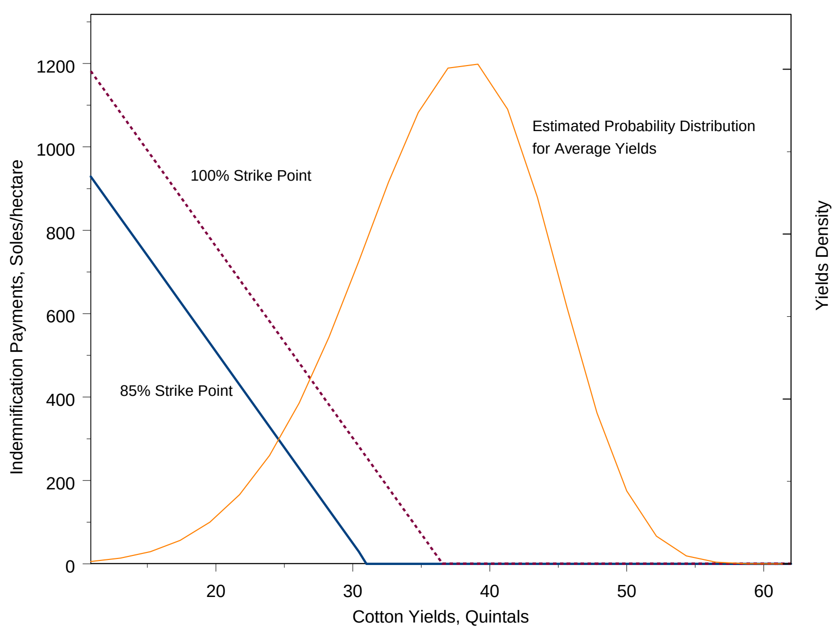
category lies –12.12 percent (below) the center of the distribution of ϵ, while the mid-point of the "good" luck category lies 11.63 percent above the center of the distribution.

To compute farmer i's per hectare profits in Soles from the insured and uninsured loan projects at each section of the valley yield and idiosyncratic shock densities, we used the following formula:

$$\Pi_{it}^{project} = (p \cdot y_{it}) * (1 + \Delta\epsilon_{it}) - (1 + r)Loan + p * Indemnity - premium, \quad (3)$$

where the price (p) of a *quintal* of cotton is set at 124.2 Soles, the loan size ($Loan$) used is 2,464 Soles (equivalent to US$800 at the time of conducting the experiment), and the interest rate (r) was set at 30 percent (the going rate at that time).[17] Insurance contract is written on 85 percent of the average valley yields, equivalent to 31 quintals per hectare (=1,674/46 = 36.4 x 0.85)[18] and the *premium* was set at 150 Soles per insured hectare.[19] Thus, the *Indemnity* (expressed in quintals per hectare) in period t is defined as $\mathbf{I}\ (y_t < 31) * (31 - y_t)$, where $\mathbf{I}(\cdot)$ is the indicator function. This indexed Insurance thus covers any shortfall in valley average yields below the 31 quintals per hectare, as depicted by the solid line in Figure 1, where we also plot the estimated *Weibull* density of the average valley yields. The indemnity function for the 100 percent contract (dotted line), with a strike yield of 36.4 quintals per hectare, is also pictured for comparison.

Figure 1: Indemnity and Valley Yield Density Functions for Pisco



Furthermore, in order to simplify the implementation of the experiment, we considered the case of the typical farmer (i.e., $\beta_i = 1$), which basically implies a one-to-one relationship between

[17]These parameters used consider the going prices at the time the experiment was implemented.

[18]This strike yield was set after game trials in Pisco, where most subjects preferred the 85 percent strike yield over the 65 percent and 90 percent strike yields.

[19]This premium includes a mark-up or load of 40 percent over the actuarially fair price (107 Soles per hectare).

farmer's yields (y_{it}) and actual average valley yields (y_t), using the expression indicated in eqn.[2]. The figures of individual yields used in the profit function in eqn.[3] then correspond to the mid-point value of the valley yields at every section of its density (23, 30, 37, 43, and 48 quintals per hectare, going from "very low" to "very high" yields): $y_{it} = y_t$. The resulting profit figures were rounded to the nearest 50.

For the fallback project, profits were adjusted accordingly to get lower but more stable profits than in the uninsured loan case.[20] We will discuss the characteristics of the resulting profits for each project in the next section.

As mentioned earlier, our behavioral experiments consisted in a sequence of two sets of games. We started with a *baseline game*, where farmers had to opt for either the fallback or the uninsured loan project. And then, we continued with an *insurance game*, where a third alternative project (loan bundled with yield insurance, or insured loan) was included in the set of choices. This sequential structure of the experiments allows us to examine any changes in farmers' choices between the first two projects after the introduction of insurance.

An important characteristic of the uninsured loan project is that when the valley average yield is *very low*, the farming income is not sufficient to repay the loan, regardless of the idiosyncratic shock. Defaulting on a loan involves two negative consequences in the experiment: no future access to credit and a 50 percent decrease in the value of the "endowed" land.[21] On the other hand, the (85 percent) insurance contract guarantees the *full* repayment of loans at every realization of the valley average yield and the idiosyncratic shock, thus allowing farmers to keep the option to choose the uninsured loan project in the future and to preserve their land value.

In the next section, we describe in detail the procedures followed in the implementation of these farming experiments.

3 Experimental Procedures and Data

Our experimental design faced two major challenges: to explain clearly the notion of probabilities associated with the different sections of the two shocks' densities, and to ensure a minimum level of comprehension of the insured and uninsured loan projects. We responded to those challenges by using transparent randomizing devices to simulate the realizations of the covariate shocks (colored chips) and idiosyncratic shocks (colored ping-pong balls), which were referred to as "individual luck" in order to denote the individual characteristics uncorrelated among subjects within a given valley. These shocks were drawn from sacks containing 10 chips (1 black, 2 red, 4 white, 2 blue, and 1 green)—the "valley sack"—and 4 balls (1 purple, 2 white, and 1 yellow)—the "luck sack"—which reproduce the probability structure mentioned earlier, going from the worst to the best outcome. Furthermore, in each of the experiment worksheets presented to our subjects, we reminded subjects the information about the probabilities under each scenario of the covariate shock and idiosyncratic shock by spacing columns and rows, respectively, in a roughly proportional manner. In addition,

[20] We further assumed a symmetric distribution for the idiosyncratic shock around the mean of zero.

[21] The value of (a hectare of) land was set at 2,400 Soles. The reduction of this value to 1,200 Soles is meant to simulate the penalty that would occur after defaulting on a collateralized loan.

we included pictures of the actual colored chips and balls associated with each scenario. Table 1 shows a sample worksheet used for the insured loan project, labeled as project C, in the actual experiments. A similar design, also printed in color, was used for the other projects' worksheets. We will discuss the profits' figures later.

Table 1: Sample Game Worksheet used for Project C

PROYECTO C: ALGODÓN CON PRÉSTAMO Y SEGURO

	Rendimiento promedio en el valle				
	Muy bajo (23 QQ)	Bajo (30 QQ)	Normal (37 QQ)	Alto (43 QQ)	Muy alto (48 QQ)
Suerte	150	150	650	1200	1850
Suerte	500	500	1250	1950	2550
Suerte	850	850	1750	2650	3250

Secondly, in order to enhance comprehension of the procedures, field assistants explained our subjects how the combination of a covariate shock and an idiosyncratic shock drawn determined the profits of the project chosen in every decision round, where each round represented a farming season. The monitor, in charge of giving the instructions to all participants as a group, further illustrated the rules and procedures with examples. We also allowed participants to ask questions during the course of the presentation of the instructions.[22] We were aware of the risks of doing this, but we actually did not receive questions that may have induced players to play in a certain way.[23]

The experiment instructions were read aloud in Spanish by the same monitor in every session. The monitor used a projector to present the information about the types of shocks, the projects' characteristics and the sequence of the actions subjects should follow in each decision round. The contents of those slides are provided in Appendix A.[24] At the beginning of every session, all participants received a binder containing the worksheets with the information of the projects' profits related to each type of covariate and idiosyncratic shocks, as well as a pencil to record their choices, the type of shocks realized, and the resulting profits in each simulated farming season. Helping subjects to see the connection between their choices, types of shocks drawn, and resulting profits, was also intended to enhance trust in our calculations of their game winnings.

The farming experiment lasted three hours on average. Total game winnings in cash from

[22]Key moments at which we specifically asked if they had any questions were: at the end of the project description, and before the low- and high-stake rounds.

[23]Most of the questions asked concerned the reasons for the differences in payoffs from particular projects under certain realizations of shocks; whether yield insurance covered losses due to hazards at the irrigation sector level; the source of the (agricultural production, cost, and valley yield) figures used for our analysis; whether the indemnity payments could be sufficient to repay the loan; or the timing of the insurance payouts; and the like.

[24]Out of the 24 sessions held, only in three of them we used posters containing the same information as in the slides for a short time. The monitor used sixteen slides to explain the farming and risk games.

participating in this particular experiment ranged from 11 to 26 Soles, with average winnings of 17 Soles (equivalent to $6). Game winnings and attendance fees were paid at the end of the entire session—which also included the conduct of the risk experiment (whose results are reported in Galarza [2009]), and pre-experiment and post-experiment surveys—that lasted on average five hours.[25]

Recall that in all of our 24 conducted sessions, participants were assigned to numbered seats at random upon arrival, and we divided the participants into at most four "valleys" with a minimum of 3 members in each one. Splitting subjects this way allowed us to get more variability in the realizations of the covariate shocks, to have a closer monitoring, and to accelerate the tasks. Two persons from our field team were in charge of each valley. A senior assistant, well versed in the game rules and procedures, recorded the players' choices and profits, and did the entry and exit surveys, while a helper assisted with the drawing of the covariate and idiosyncratic shocks.

Let us consider now the structure of profits associated with each type of covariate and idiosyncratic shock that was shown to our subjects. Table 2 reports the profits calculated without considering the probability of losing land. As seen in the table, the uninsured loan project (labeled as project A) has higher, but more volatile, expected profits than the other two projects; with the fallback project (project B) being the least profitable project in expectation and the one with the lowest standard deviation (the safest). More specifically, the mean profits of the projects are: 1,355 (project A), 735 (project B), and 1,283 (project C), while their standard deviations—reported in Table 3, columns 2 to 4—are 859, 331, and 767, respectively.

On the other hand, considering the probability of losing land (i.e., of losing 1,200 Soles when project A is chosen and a very low valley yield is realized) in the profits' calculation, the mean profit of the insured loan project becomes now the largest. We should mention, however, that this effect was rather hidden in the experiment, and most likely our subjects did not consider their land value (or at least not to its full extent) in the calculations of profits of the different projects. To make the figures comparable with those shown in the prior table, we only changed the profits for project A under the very low average yield (reported a net loss of –1,200 instead of 0), while in the other two projects, no land losses are realized. As a result, while yield insurance only decreases from 859 to 767 the standard deviation of profits[26] when no land losses are considered (see columns 2 and 4 of Table 3), we can see a much greater reduction in volatility when land losses are included in the profits calculation (from 1,099 to 767 in their standard deviations[27]). While we can easily notice that the expected benefits from buying insurance would be even greater in an intertemporal context, in which the land not lost would yield potentially greater profits, we believe that this effect was poorly perceived by our subjects.[28]

[25]After the farming games, a risk game, which lasted about 30 minutes on average, was run. The rest of the time—one hour and a half—was spent conducting the entry and exit surveys.

[26]To see more clearly the magnitude in the reduction of profits' risk, this implies a reduction from 0.63 to 0.60 in the coefficient of variation of profits.

[27]Which implies a substantial reduction in the coefficient of variation from 0.89 to 0.60 due to insurance.

[28]One interesting extension, which is beyond the scope of this paper, would be to consider that farmers use decision weights instead of objective probabilities in their expected calculations and to examine the ranking of mean and standard deviation of those projects.

Table 2: Farming Game Profits
(Expressed in Soles per hectare)

			Valley-Wide Average Yield					
			Very Low (23 QQ) *[0.10]*	Low (30 QQ) *[0.20]*	Normal (37 QQ) *[0.40]*	High (43 QQ) *[0.20]*	Very High (48 QQ) *[0.10]*	*Mean*
Project A: Produce cotton with loan (uninsured loan)								
L	Bad	*[0.25]*	0 [1]	250	800	1,350	2,000	*840*
u	Normal	*[0.50]*	0 [1]	600	1,400	2,100	2,700	*1,370*
c	Good	*[0.25]*	0 [1]	900	1,900	2,800	3,400	*1,840*
k	*Mean*		*0*	*588*	*1,375*	*2,088*	*2,700*	*1,355*
Project B: Produce cotton without a loan (fallback)								
L	Bad	*[0.25]*	300	400	600	900	1,350	*665*
u	Normal	*[0.50]*	350	450	650	1,000	1,500	*735*
c	Good	*[0.25]*	400	500	700	1,100	1,650	*805*
k	*Mean*		*350*	*450*	*650*	*1,000*	*1,500*	*735*
Project C: Produce cotton with a loan & insurance (insured loan)								
L	Bad	*[0.25]*	150	150	650	1,200	1,850	*730*
u	Normal	*[0.50]*	500	500	1,250	1,950	2,550	*1,295*
c	Good	*[0.25]*	850	850	1,750	2,650	3,250	*1,810*
k	*Mean*		*500*	*500*	*1,225*	*1,938*	*2,550*	*1,283*

Note: Subjects were shown this table, *except* for the averages and probabilities.
[1] The values of unpaid debts were 700 (Bad luck), 350 (normal luck), and 50 (good luck).

Thus, instead of focusing on expected profits, we will argue that risk aversion considerations could better guide an ordering in preferences. One could then state that as risk aversion goes up, subjects would tend to switch from the uninsured loan (A) to the insured loan project (C), and then to the fallback project (B). This ordering, which also corresponds to the ranking according to the standard deviation of the three projects' profits shown in Table 3, will be used in the econometric analysis performed in Section 4.

Turning now to the experiment procedures followed, as mentioned above, our farming games involved selecting cotton production projects in a repeated fashion. These experiments started with the *baseline game*, and continued with the *insurance game*. As is customary in experimental economics, each of those games started with a set of (six) "low stakes" rounds, intended to get subjects familiar with the game rules and procedures, which were followed by a set of (six) "high stakes" rounds. Further, subjects knew that all sets of rounds would end with the sixth one.[29]

In the baseline game, subjects chose between the fallback (which we labeled as project B: *cotton without a loan*) and the uninsured loan (which we labeled as project A: *cotton with a loan*) projects.

[29] After several game trials, we chose six rounds because it showed to have sufficient variability in the covariate shocks. In particular, we were interested in getting a very bad valley-wide averge yield in each six-round campaign, so that farmers would *learn* first hand the consequences of choosing the loan project.

Table 3: Farming Game Payoffs: Mean and Standard Deviation
(Expressed in Soles per hectare)

	Without losing land			Losing land[1]		
	Project A	Project B	Project C	Project A	Project B	Project C
Mean	1,355	735	1,283	1,235	735	1,283
Standard Dev.	859	331	767	1,099	331	767
Ordering considering:						
Mean	1st	3rd	2nd	2nd	3rd	1st
Std. Dev.	3rd	1st	2nd	3rd	1st	2nd

[1] Only the profits from project A under the very low valley yield changed (from 0 to -1,200).

The sequence of events in each round of play, t, was as follows:

(i) All players selected their favorite projects;

(ii) (starting clockwise in each valley, v) one player drew a covariate shock (represented by a colored chip) from the valley sack. Players rotated this picking-the-chip role;

(iii) then each player i drew his or her own idiosyncratic shock or "luck" (colored ball) from the luck sack;

(iv) our assistants explained the profit corresponding to the triplet {`project chosen`$_{ivt}$`, covariate shock`$_{vt}$`, idiosyncratic shock`$_{ivt}$} to each subject.

Once the six rounds were played, one of them was randomly chosen for play by having a participant in each valley roll a six-sided die. We used this random incentive design in order to preserve the proper incentives to carefully select *every* choice. This selection criterion of the round for play was reminded to all subjects at the beginning of each set of six rounds.

Furthermore, in order to include the effects of losing collateral into the decision-making, the total game *payoffs* included the value of the endowed land at the end of the every set of six rounds, in addition to the game profits obtained from the project chosen. In order to determine the final land value, we used the following rule: regardless of which round was chosen for play, as long as in *any* of them the following combination {`uninsured loan; black chip, any colored ball`} resulted, farmers were paid half of the original land price.[30]

The low-stake rounds were followed by a set of six "high-stake" rounds, where subjects started again with a clean slate: full access to loans, and a hectare of land with its original value. The procedures and rules were exactly the same as we described earlier, and the only change was the increase in 100 percent in the exchange rate to compute the winnings in cash, as a way to incentivize more careful decisions. Thus, now for every 600 game Soles of payoffs (profit + land value), participants would receive 1 Sol in cash. Subjects learned their winnings in cash at the end of each set of six rounds.

[30]The reduction in the value of land tries to capture the consequences of defaulting a loan, in terms of reducing the future expected gains. Anecdotal evidence from Pisco suggests that seizing the land is not a frequent procedure in the formal or informal credit markets even if the lender has a mortgage in hands.

After playing the baseline game, the insurance game, consisting of a new set of 12 rounds where the insured loan project (project C) was added to the set of choices, was played. In this new game, the rules and procedures followed, and exchange rates used were exactly the same as the ones described above. We emphasized with subjects that the results from the baseline game (i.e., whether subjects' defaulted on a loan or not) did not carry over to the insurance game. Written on 85 percent of the long-run average valley yields, insurance pays out indemnities when valley yields fall below 31 quintals per hectare; i.e., when valley yields are "low" (30 quintals per hectare) or "very low" (23 quintals per hectare), which will happen when a black chip or a red chip are drawn in a valley. We should note in Table 2 that, since indemnity payouts cover exactly the shortfalls under those sections of the distribution, the amount of the profits are the same for every category of idiosyncratic shock (150, 500 and 850).

3.1 Descriptive Analysis of Experiment Results

Before we examine the characteristics of our subjects in the baseline and insurance games, we should mention that our typical experimental subject is older than 50 (half of which has been spent managing a farm), has only completed elementary education (six years of schooling), owns 6 hectares, sows 5 of them, and holds assets for twenty thousand Soles (about $7,000), as shown in Table C.1 in the Appendix. Further, 66 percent of our subjects have access to any type of credit, and they exhibit a moderate to high risk aversion. We will examine more closely these variables later.

This section examines the main characteristics exhibited by our subjects in the Baseline Game and in the Insurance Game, as a means to provide clues for the econometric analysis of the main predictors of insurance take-up performed in the next section (Section 4). Since we are interested in capturing the choices that contain the most information possible, the following analysis will use the last high stakes round at which subjects stopped learning about the different projects, which is the last high stakes round (if subjects did not fall in default) or the round immediately prior to the one in which subjects fell in default (given that immediately after that round, subjects are only left with the fallback project). We call this round the *final unconstrained round*.[31]

Table 4 shows one of our major results, the matrix of project choices made by subjects in the baseline game (indicated in rows) and in the insurance game (in columns). We observe at the bottom of column 5 that a large proportion (57 percent) of the experimental subjects chose the insured loan project, a proportion that was similar in all of the high stakes rounds. (The average number of switches in project choices is 0.80, with a standard deviation of 1.31.) Another interesting result is that purchasing insurance would encourage almost 14 percent (52 out of 378) of subjects to opt for a loan instead of producing using their own resources (see cell {B,C} in the matrix), thanks to the reduction in the likelihood of default implied by insurance. Another lecture of the same figure indicates that about 60 percent (52 out of 91) of the risk rationed subjects (i.e., those who chose the fallback project in the baseline game[32]) switched to the insured loan project

[31]During the first high stake round of the insurance game, 2.6 percent of subjects went into default.

[32]Obviously, we are assuming here that these subjects are risk rationed in real life, a result that may not necessarily

when it was available. This is one of the intended effects of insurance: to encourage farmers to undertake riskier but potentially more profitable projects.

We can further see in the table that a relatively small proportion of subjects made choices inconsistent with transitivity in preferences (34 out of 378, or 9 percent). In particular, 20 out of 91 subjects who selected the fallback project over the uninsured loan project in the baseline game (cell {B,A}) switched to the uninsured loan project in the insurance game, and 14 out of 287 subjects who chose the uninsured loan in the baseline game (cell {A,B}) switched to the fallback project in the insurance game. Note that since we are working with the final unconstrained rounds, these choices were made *before* any bad year (i.e., a black chip drawn in a round) happened when the uninsured loan was selected, and thereby they are likely to reflect their true preferences.[33]

Table 4: Choices in Baseline and Insurance Games

		Insurance Game				
		Uninsured loan (A)	Fallback (B)	Insured loan (C)	Total	%
Baseline Game	Uninsured loan (A)	109	14	164	287	*75.9*
	%	*38.0*	*4.9*	*57.0*	*100.0*	
	Fallback (B)	20	19	52	91	*24.1*
	%	*22.0*	*20.9*	*57.1*	*100.0*	
	Total	129	33	216	378	*100.0*
	%	*34.1*	*8.7*	*57.1*	*100.0*	

Before we discuss the main distinctive characteristics of subjects in the baseline and insurance games, we need to define one of our major variables of interest: financial literacy. In constructing a measure of the degree of comprehension of the main features of the insured and uninsured loans, we included four topics: (i) self-reported comprehension of the farming game rules (variable *Self-report*), (ii) whether subjects knew (reminded) that insurance indemnity payouts depend on valley-wide average yields (*Learn_ins1*) and (iii) not on idiosyncratic shocks (*Learn_ins2*), and (iv) whether they knew the two consequences of defaulting on a loan (*Learn_loan*). We assigned the same weights to each of these variables:

$$Financial\ literacy = (Self\text{-}report + Learn\_Ins1 + Learn\_Ins2 + Learn\_Loan)/4;$$

where *Self-report* takes the values of 1, 0.75, 0.5, or 0.25 if subjects claimed that the instructions were "very easy", "easy", "hard", or "very hard", respectively. *Learn_Ins1* and *Learn_Ins2* are indicator variables that take the value of 1 if the answer was correct and 0, otherwise. *Learn_Loan* takes the value of 1 if the two consequences of defaulting an uninsured loan (i.e., no future access to loans and land depreciation) were indicated by subjects; 0.5 if only one of those were mentioned; and 0 otherwise. We then normalized this indicator to take values between 0 (which means that

hold.

[33]Using the modal choice during the high-stake rounds would result in a take-up rate for the insured (uninsured) loan of 58.5 percent (24.3 percent), and 37.6 percent of risk rationed subjects, with 57 percent of them switching to the insured loan in the Insurance Game.

a subject does not know anything about the rules of the game) and 1 (which indicates that a subject knows very well the rules). The average value of this indicator across subjects is 0.54, which indicates an overall moderate level of comprehension.[34]

We will also examine the results in terms of risk preferences. Such preferences were estimated from the results of a lottery experiment conducted with the same Pisco subjects, where the data were fitted to Constant Relative Risk Aversion (CRRA) utility functions under Expected Utility Theory (EUT) and Cumulative Prospect Theory (CPT).[35] The estimated average coefficients of CRRA of 0.45 (EUT) and 0.74 (CPT) suggest the existence of a moderate to relatively high degree of risk aversion. The interested reader is referred to our companion paper (Galarza, 2009) for details.

We discuss next the main distinctive characteristics of the two groups of subjects in the baseline game, and then of the three groups of subjects in the insurance game. The results from this section will provide insights about the variables correlated with the demand for the insured loan that will be analyzed in Section 4. Recall that, unless otherwise indicated, we will use the final high stake round in which farmers had a choice to make (i.e., the final unconstrained round) in the analysis.

3.1.1 Baseline Game: Risk-Rationed Subjects *versus* Uninsured Borrowers

Table C.2 in the Appendix shows the means T-tests of selected variables for the two groups in the baseline game. In particular, we observe that uninsured borrowers include a lower proportion of females and a bigger owned and cultivated parcel size (by one hectare) than risk-rationed subjects. The former group also appears to be more connected to agricultural information networks, as indicated by their bigger number of information partners (i.e., people with whom they exchange information about farming activities, such as pests control, new seeds, and the like). They also have a greater access to loans from any source in real life, mainly explained by their greater access to loans from cotton mills, not from formal lenders. Furthermore, uninsured borrowers show a lower tendency to overweight small probabilities, meaning that when they are told an event has a small probability of happening, they act *as if* such event were to happen with a *higher* probability.[36] We will discuss in more detail the effects of this type of psychological distortion of probability information in Section 4. For all of the above indicated variables, the differences in means between risk-rationed and uninsured borrowers are significant at either 1 or 5 percent. On the other hand, while uninsured borrowers have higher financial literacy, such differences are barely significant. Likewise, the formal education levels and risk aversion estimates shown by those two groups are

[34] If we excluded the self-reported comprehension variable (*self-report*), such an indicator would have an average value of 0.50, and the correlation coefficient with education would be 0.37.

[35] Under EUT, risk preferences are entirely defined by the curvature parameter, while in CPT, a probability weighting function parameter also affects such preferences. This function captures the subjective distortions made to actual probabilities. More details of the estimation process are provided in Section 4.1.

[36] To illustrate the notion of overweighting of small probabilities, let us take the case of a lottery, whose chances of winning its biggest prize is say 0.001. Now, let us consider that subjects transform such 0.001 into a subjective probability of 0.01; that is, they behave *as if* they could get the highest prize weere bigger than it actually is. The consequence of this is that for a given curvature of the utility function, they would behave in a more risk seeking manner than such curvature would suggest. Levy and Levy (2002) nicely analyze the consequences of probability weighting on the lotteries' risk premium.

similar.

In the econometric analysis about the choices made in the insurance game performed in Section 4, we will control for choices made in the baseline game by including as an independent variable the predicted probability of choosing the fallback project in this game, which will in turn be estimated as a linear function of gender, age, education, and owned land size variables.

3.1.2 Insurance Game: Insured Borrowers *versus* the Others

Comparing insured borrowers to uninsured borrowers and risk-rationed producers, Table C.3 in the Appendix shows that insured borrowers are markedly different from the other two groups in several important respects: demographics, literacy, productivity, assets, risk preferences, as well as market and social connections.

First, insured borrowers are significantly younger (by two years) and have higher education (by one year) than uninsured borrowers; and this gap is even bigger when we compare insureds to risk-rationed subjects. Second, insured borrowers are also more likely to have better understood the properties of insurance than the other two groups of subjects, a result reflected by their higher values of the variable *Financial Literacy*. Third, insureds also report higher cotton yields in the last farming season (2007-2008), though this difference is statistically significant (at 5 percent level) only when insureds are compared to risk-rationed subjects (the gap is 6 quintals, or 276 Kilograms per hectare). Fourth, insureds own more valuable assets, denoted by the variable *Wealth* (that includes the values of land and house), a result that is mainly explained by their more valuable houses. In fact, insureds' house values are 50 percent higher than those of uninsured borrowers, and this gap is even larger when we compare insured to risk-rationed subjects. Furthermore, while insureds do have significantly bigger parcels than risk-rationed subjects (by one hectare), such gap vanishes when we compare insureds to uninsured borrowers.

Fifth, surprisingly, risk-rationed subjects are more risk averse than uninsured borrowers, who are in turn more risk averse than insured borrowers; and such differences in risk aversion are statistically significant (at 10 percent) under the EUT and the CPT specifications. How can we explain this seemingly counterintuitive result? In particular, why should higher risk averse subjects choose the uninsured loan instead of the insured loan?: The fact that (higher) risk aversion under EUT and CPT is highly correlated with a lower education attainment and a lower financial literacy suggests that higher risk averse subjects are less likely to have understood the true dynamic benefits from buying crop insurance. Having a relatively poor understanding of this insurance, risk averse subjects would thus have opted for either the safest (fallback) project or a project they know relatively well in real life—the uninsured loan.

Sixth, insured borrowers are also more likely to have obtained a loan to finance their agricultural activities than risk-rationed subjects, but less likely so than uninsured borrowers (significance at 5 percent level). Seventh, considering the number of experimentally-constructed valley members with whom an individual shares information about farming activities as an indicator of social connection, we find that insured and uninsured borrowers are similarly connected with other farmers—the agricultural 'networks' have on average 1.7 members—while groups belong to a slightly bigger agricultural network than risk-rationed farmers. Eighth, the winnings from the low stakes insurance game are (expectedly) higher for subjects choosing the insured loan than those obtained by subjects who chose the fallback project. Ninth, overweighting is the greatest for those who chose the fallback project, and lowest for those choosing the insured loan. Lastly, we do not observe statistically significant differences in terms of gender, farming experience, or belonging to a farmer association amongst these three groups.

To sum up then, we saw that financial literacy, wealth, risk preferences, and social network variables are likely to be correlated with the project choices made in the insurance game, and we will include those variables in the regression analysis. We discuss in the next section the econometric methods used in the estimation of those project choice decisions and the main estimation results.

4 Econometric Specification

We estimate ordered logit models, using the choices made in the *final unconstrained round*. The ordering is given by what we could roughly expect, based on risk preferences; that is, as risk aversion increases, one could wait to see subjects switch from the uninsured loan to the insured loan and then to the fallback project: A→C→B. Thus, the dependent variable, y_i, which denotes the project choice by individual i, will take the value of 1, if the fallback project was chosen; 2, if it was the insured loan project; and 3, if it was the uninsured loan project.

Using the latent utility framework, we define y_i^* as an unobserved measure of utility for individual i:[37]

$$y_i^* = X_i'\beta + \epsilon_i, \tag{4}$$

where ϵ_i will be assumed to follow a logistic distribution, and X is the vector of regressors. Thus, for our three-category ordered model we have that,

$$y_i = j \qquad \text{if } \alpha_{j-1} < y_i^* \leq \alpha_j, \quad j = 1, 2, 3, \tag{5}$$

with $\alpha_0 = -\infty$ and $\alpha_3 = \infty$, where the $\alpha' s$ indicate the cut points or thresholds that define the project choice. Using the prior two equations, the probability of choosing project j can be expressed as follows:

$$\begin{aligned} \Pr(y_i &= j) = \Pr(\alpha_{j-1} < y_i^* \leq \alpha_j) \\ &= \Pr(\alpha_{j-1} - X_i'\beta < \epsilon_i \leq \alpha_j - X_i'\beta) \\ &= F(\alpha_j - X_i'\beta) - F(\alpha_{j-1} - X_i'\beta), \end{aligned} \tag{6}$$

where $F(\cdot)$ is the cumulative probability distribution of ϵ_i. The parameter vector β and the cutpoint

[37] I am drawing on Cameron and Trivedi (2009) for this part.

parameters α result from maximizing the following log-likelihood function:

$$\ln L(\alpha, \beta \mid X) = \sum_{i=1}^{N} \sum_{j=1}^{3} \ln \left[F(\alpha_j - X_i'\beta) - F(\alpha_{j-1} - X_i'\beta) \right]^{y_{i,j}}, \tag{7}$$

where $y_{i,1}, y_{i,2}, y_{i,3}$ are three indicator variables with $y_{i,j} = 1$ if $y_i = j$, and $y_{i,j} = 0$, otherwise. We are interested in obtaining the marginal effects of a unit change in the k-th regressor on the probability of choosing project j, which is given by:

$$ME_{i,j,k} = \frac{\partial \Pr(y_i = j)}{\partial X_{i,k}} = \left[F'(\alpha_{j-1} - X_i'\beta) - F'(\alpha_j - X_i'\beta) \right] \beta_k. \tag{8}$$

We will evaluate the $ME's$ at the sample means of the regressors ($\overline{X}_i$).[38] The interpretation of the marginal effect is straightforward: a $ME_{j,k} > (<)\ 0$ means that the probability that project j is chosen will increase (decrease) by $ME_{j,k}$ as a result of a one unit increase in X_k. We run these ordered logit regressions with standard errors clustered by the experimentally-constructed-valleys, in order to correct for a possible intra-cluster correlation. We also include region fixed effects in the regressions in order to control for spatially correlated decisions. The next section discusses the estimation results, which were run in `Stata` 10.

4.1 Empirical Analysis

Who would be interested in choosing the insured loan? Those who have a higher valuation of money when large-scale negative shocks happen, and thus suffer more from drastic downturns of money. We will discuss the effects of wealth, financial literacy, social connections, choices in the baseline game, winnings in the low stakes rounds, game effects, risk aversion and nonlinear probability weighting, on the demand for the insured loan project (project C). We also present the results for the uninsured loan project (project A), for comparison.

The base specification includes *Wealth* (in 10,000 Soles), *Financial Literacy,* and a variable measuring the degree of social connection existing in the experimentally-constructed valleys, as independent variables. Wealth includes the value of land and house and our financial literacy indicator intends to capture the level of comprehension that subjects have about the main features of the insured and uninsured projects. Crop yield insurance is a new product to all of our experimental subjects, and the prior knowledge of insurance products of any type is very limited in our sample.[39] Recall that the financial literacy indicator takes values between 0 (meaning that subjects do not know anything about the insured and uninsured loan projects) and 1 (meaning that subjects know very well those projects), as mentioned above in Subsection 3.1. Moreover, recall that our subjects were randomly assigned to numbered seats and grouped into "valleys" in each

[38]In this case, the marginal effect of a dummy variable is computed as the difference of the predicted value at 1 and the predicted value evaluated at 0.

[39]Only 36 percent of our subjects have health insurance, mostly offered by the public sector; 10 percent have accident insurance (mostly car insurance, which is mandatory for public transportation vehicles); and 12 percent have life insurance. None of our subjects has ever had any type of crop insurance.

experimental session. Thus, our *Agricultural Network* variable indicates the number of subjects in a given valley with whom a person shares information about farming activities.[40] This variable also controls for potentially correlated decisions within each experimental valley.[41]

In addition, since the choices made in the high stakes insurance game may be correlated with those made in the high stakes baseline game, we will include a control variable that predicts choices made in the baseline game. More specifically, we include the predicted probability of being *Risk Rationed* (i.e., the probability of choosing the fallback project in the baseline game).[42] We will also control for "wealth" effects—that is, subjects may have chosen differently in the high stakes depending on how much winnings they had in the prior rounds of the insurance game—by including the variable *Prior Rounds Earnings*, which measures the winnings in Soles from the low stakes rounds in the insurance game. Finally, we will control for the potential existence of a source of judgment bias called "hot-hand" effect, which may arise from an attempt to discover trends in past information and results in an overestimation of the autocorrelation in the series of good or bad events.[43] Focusing on negative events, this bias would imply that, for instance, drawing two consecutive black chips (which means that a very low average yield was drawn in a particular farming season) may lead subjects to erroneously think that those events are autocorrelated and would then drive them to rely on a safe project (i.e., either the fallback or the insured loan projects). This overreaction notion is closely related to the overweighting of probabilities information, in the sense that the probability of a bad *recent* event is overvalued, thus resulting in a too optimistic or too pessimistic behavior. To control for this "hot-hand" effect, we use a dummy variable for drawing two consecutive black chips in the last two low stakes rounds of the Insurance Game, and we expect a positive (negative) correlation with the insured loan take-up if there is an overestimation (underestimation) of the autocorrelation in the series of black chips: once two black chips are drawn, those subjects overestimating (underestimating) such autocorrelation would (not) expect another black chip to be drawn in the next rounds, thus judging the insured loan project—that eliminates the chances of a loan default if a black chip is drawn—more (less) attractive than the uninsured loan.

Lastly, we include two experimentally measured variables—risk aversion and overweighting of small probabilities—estimated in Galarza (2009). The Constant Relative Risk Aversion (CRRA) coefficient was estimated from a binary lottery game in which subjects chose between a relatively safe lottery and a relatively risky lottery along ten decision rows. Prizes are held constant in each row, while the probability of the higher prize in each lottery decreases as the game progresses. The idea of this design is that (unless subjects are extremely risk loving) subjects should start choosing the safe lottery and switch to the risky lottery before the 10th row, because in that row, the prize

[40]Including demographic indicators would not change the results significantly.

[41]While it could have been interesting to capture the way information is aggregated within different valleys and how it is then translated into decisions under risk, by simply including the size of the agricultural network, we expect to control for the influence that the members within a valley may have had on individual's project choices.

[42]We estimated a *Probit* regression of the unconstrained final high stakes round in the baseline game on age (in years), education (years), gender, and owned land size (hectares).

[43]Offerman and Sonnemans (2004) report some evidence of the overrreaction resulting from hot-hand effects in sports and financial markets. They further desing an experiment to distinguigh between hot-hand and recency effects, the latter being the bias towards overweighting recent information and underweighting prior beliefs.

from the risky lottery is *for sure* greater than that from the safe lottery. In this lottery game, subjects can switch back and forth between lotteries. Using maximum likelihood and assuming a linear relationship between individual characteristics (age, education, and geographic location) and risk preferences, Galarza (2009) finds evidence of risk aversion and probability distortions (in particular, that subjects overweight small probabilities) that characterizes Cumulative Prospect Theory (CPT),[44] and that higher education is significantly correlated with lower risk aversion.

Turning to the regression results shown in Table 5, model (1) [see columns 2-3] includes the risk estimate under EUT and model (2) [see columns 4-5] includes the risk and overweighting parameters estimated under CPT as independent variables.[45]

Consider column 2, which reports the marginal effects for the insured loan (project C) considering model [1]. We see that wealth is positively correlated with the insured loan take-up, though the magnitude of its impact is small: with average assets of 20 thousand Soles (see Appendix Table C.1), this means that a 50 percent increase in assets over such an average would imply an increase in the probability of choosing the insured loan by almost 4 percent. Financial literacy enters the regression with a positive sign but an insignificant coefficient (*p-value* is 0.22). Similarly, the size of the agricultural information network and the predicted probability of being rationed in the baseline game appear with insignificant coefficients in the regression (the *p-value* in the latter case is 0.164). On the other hand, we do observe evidence of the existence of wealth and "hot-hand" effects, though in the former case, the coefficient is barely significant (*p-value* is 0.113); thus, while earnings obtained during the low stakes rounds of the insurance game are positively correlated with the insured loan take-up (one more Sol earned is correlated with a 7 percent increase in the insured loan take-up rate), drawing two more chips in the last low-stake rounds in the insurance game (a one-percent probability event) would imply a reduction in the insured loan take-up rate by 37 percent. Finally, risk aversion estimates under Expected Utility Theory enter with a negative and significant coefficient in the regression (*p-value* is 0.037). Contrary to what classical microeconomic theory states, higher risk averse subjects are found to be *less* prone to choose the insured loan; a result that may be explained by the fact that those subjects are significantly *less* likely to have understood the intertemporal and dynamic benefits of insurance (the correlation coefficient between risk aversion and the financial literacy variable is –0.26 and is significant at 1 percent), thus being *less* likely to choose the insured loan.

We should mention that in all of the previous cases, the magnitude of the marginal effects for the demand for the uninsured loan (reported in column 3) are similar but with the opposite sign to those for the insured loan. Given that the marginal effects add up to zero for the three categories/projects considered), this means that the marginal effects for the fallback project are negligible.

[44] In addition to the curvature of the utility function, a probability weighting function parameter that captures the subjective probability distortions, is also estimated under CPT. Defined over lottery gains, a nice feature of CPT is that if no such probability distortions are found, the model collapses to EUT. For a discussion of the main features of CPT, see Tversky and Kahneman (1992).

[45] Given the Tversky and Kahneman (1992) one-parameter weighting function used in the estimation performed in Galarza (2009), a value of 0.7 or less of such a parameter implies such overweighting pattern.

Table 5: Multiple Choice Model (Ordered Logit
Regressions weighted by the inverse of the risk estimate variance
Marginal effects for the insured loan (C) & uninsured loan (A) are reported

Variable	Model (1)[1] Insured Loan	Model (1)[1] Uninsured Loan	Model (2)[2] Insured Loan	Model (2)[2] Uninsured Loan
Wealth (10,000 Soles)	0.036	-0.030	0.047	-0.039
	(0.020)*	(0.017)*	(0.018)**	(0.015)**
Financial Literacy Indicator	0.195	-0.166	0.155	-0.130
	(0.160)	(0.135)	(0.162)	(0.135)
Number of Peers in Agric Network	-0.008	0.007	-0.008	0.006
	(0.021)	(0.018)	(0.022)	(0.018)
Est.Probability of Being Risk Rationed[3]	0.776	-0.660	0.783	-0.655
	(0.558)	(0.474)	(0.574)	(0.489)
Prior Rounds Earnings–Soles[4]	0.071	-0.061	0.074	-0.062
	(0.045)‡	(0.038)	(0.042)*	(0.034)*
Two Black Chips, Insurance Game[5]	-0.369	0.359	-0.347	0.329
	(0.183)**	(0.204)*	(0.213)†	(0.227)
CRRA Estimate	-0.252	0.214	-0.308	0.257
	(0.120)**	(0.102)**	(0.142)**	(0.118)**
Overweighting of Small Probabilities[6]	n.a.	n.a.	0.114	-0.097
			(0.121)	(0.105)
Mean of dependent variable	0.57	0.34	0.57	0.34
Number of Observations	349		349	
Pseudo R-squared	0.063		0.086	

n.a.: not applicable. *(**)[***] denotes significance at 10%(5%)[1%] level. †{‡} *P-values* of 0.103 {0.113}.
Robust standard errors clustered by the experimentally-constructed-valleys are reported in parenthesis.
All regressions include region fixed effects.
[1] CRRA estimated assuming Expected Utility Theory-EUT with Fechner errors.
[2] CRRA estimated assuming cumulative prospect theory-CPT with Fechner errors. [3] Estimated using a *Probit* model with age, education, gender and land size as independent variables. [4] In low stakes Insurance Game. [5] Indicator variable for drawing two black chips in the last two low stakes rounds.
[6] Indicator variable that takes the value of 1 if the weighting function parameter falls below 0.7.

On the other hand, similar results hold when we include a measure of the overweighting of small probabilities, in addition to the estimate of the curvature of the utility function parameter, which characterizes Cumulative Prospect Theory (CPT). As reported in column 4 of Table 5 (marginal effects for the insured loan, project C), in general, the impact of the regressors that resulted statistically significant under EUT becomes greater under CPT. In particular, wealth turns highly significant (*p-value* is 0.010), and its marginal effect is more responsive than under EUT; similarly, the marginal effect of earnings in cash from the low stakes rounds of the insurance game increases slightly and becomes significant (*p-value* is 0.077). In contrast, the variable capturing "hot-hand" effects—drawing two consecutive black chips—loses significance due to the inclusion of the overweighting-of-small-probabilities indicator.

Finally, in interpreting the effect of the curvature of the utility function parameter, we should note that under CPT, there is an additional sources of risk aversion—the parameter of the probability weighting function (Tversky and Kahneman, 1992). Thus, for a given curvature of the utility function, risk aversion is *offset* by overweighting of small probabilities (Fox and Poldrack, 2009). This explains why the marginal effect of the curvature parameter and that of the variable reflecting the overweighting of small probabilities have opposite signs: while a higher risk aversion estimate is associated with a lower demand for the insured loan by 31 percent (significant at 5 percent level), overweighting small probabilities is correlated with a 11 percent increase in the probability of choosing the insured loan, though its marginal effect is not significant (*p-value* is 0.346).

5 Conclusion

In a context of collateral-constrained formal credit markets, the introduction of insurance can help enhance the demand for credit by reducing the fear of losing collateral that prevents potential borrowers from taking loans. This paper provides experimental evidence of such desired credit crowding-in effect of insurance in rural Peru. Framing our experiments to recreate a similar environment to the choices and outcomes that farmers have in real life, we started with a Baseline Game where subjects had to choose between a fallback (safe) production project or produce using an uninsured working capital loan (risky project). We then introduced a third project—producing cotton with an insured loan— which allows us to measure the effect of insurance on the demand for loans. We thus find that while about a quarter of our subjects are risk rationed, meaning that they chose to do the fallback project in the baseline game, about 60 percent of those subjects switched to the insured loan project when it was available.

Overall, in the Insurance Game, more than 50 percent of the subjects chose the insured loan during the high stakes rounds. Given that this insurance contract eliminates by construction the chance of loan default, this demand is likely to reflect the fear of losing collateral when one is unable to repay a loan. One could suspect that this very high insurance take-up rate may simply reflect subjects' desire to "try that new product" out of curiosity. There are two reasons to believe that this was not the case. First, the insured loan take-up does not fluctuate much even during the low stakes rounds. Second, and more interestingly, using contingent valuation questions in the post-experiment survey, we verify that indeed about 55 percent of farmers indicated that they would be willing to buy the insured loan contract with the premium of 150 Soles per hectare.

On the other hand, the econometric results of the main predictors of the demand for the insured loan show that, controlling for choices in the baseline game and some "game" effects, wealth is positively correlated with a greater probability of choosing the insured loan project, while higher risk averse subjects are found to be *less* prone to choose the insured loan. This last finding seems counterintuitive, but may be explained by the fact that higher risk averse subjects are significantly *less* likely to have understood the intertemporal and dynamic benefits of insurance, thus being *less* likely to choose the insured loan. The negative effect of risk aversion on the demand for the insured loan is reinforced when we account for the subjective probability distortions in the regression. There is certainly work to do in order to fully understand this result; but nonetheless, this evidence should provide some clues to explore some departures from the standard microeconomic theory. In this line of research, examining the importance of psychological factors behind the decisions to adopt innovative financial instruments will likely prove to be useful.

This paper contributes to the existing literature about the use of behavioral experiments to predict financial decisions made in a risky environment. A novel feature of our experimental design is that it involves choices over alternative projects related to agricultural production decisions—a fallback, safe production plan, taking up an uninsured loan to finance agricultural production, and taking up a loan bundled with crop insurance—whose end-of-season profits depend on the realizations of two random shocks, one intended to reflect the effects of covariate, systemic variables and the other, the effects of idiosyncratic factors. We then use the random incentive mechanism, which consists in picking one of the project choices made by subjects at random, in order to elicit true preferences. Our experimental design can also be used to educate potential beneficiaries about virtually any new financial product, with some adaptation.

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Appendix A. Information Shared with Subjects

1. Number and color of chips by type of valley-wide average yields (VAYs): black, red, white, blue, green
2. Historical valley-wide average cotton yields: 1986-2006 (bar graph)
3. Project A (cotton with loan) payoffs for the normal individual luck (luck dimension not shown) by type of VAY
4. Example of calculating the payoffs for the normal individual luck (luck dimension not shown) with normal VAY
5. Number and color of balls by type of individual luck: purple, white, yellow
6. Project A's payoffs (by type of luck and category of VAY)
7. Project B's payoffs (by type of luck and category of VAY)
8. Project A's and B's payoffs (by type of luck and category of VAY) on the same page
9. Project C's payoffs (by type of luck and category of VAY)
10. Project A's, B's & C's payoffs (by type of luck and category of VAY) on the same page
    {*End of Farming Games*}
11. Maximum and minimum prizes of lotteries
12. Lotteries' payoffs for decision row 2
13. Lotteries' payoffs for decision row 8 (symmetric to 2)
14. Lotteries' payoffs for decision rows 2 and 8 (together)
15. Practice game sheet for binary lottery game (ten decision rows)
16. Game sheet for high-stake binary lottery game (ten decision rows)
    {*End of Lottery Game*}

Appendix B. Summary of Experimental Procedures in Farming Games

The following is the structure of the farming games conducted in Pisco.

- Entry survey
- Introduction of the experimental session
- Presentation of the experiment: goals
- Description of project A: cotton with loan
  - Description of Covariate shock: valley-wide average yield (VAY), *slide*
    - Examples of how different colored chips represent distinct types of VAY
    - Example of how different colored chips imply different profits, *slide*
    - Example of how the payoff for the normal VAY was calculated, *slide*
  - Description of Idiosyncratic shock: individual luck, *slide*
    - Example of how different colored balls (and different colored chips) imply different profits for project A (uninsured loan)
  - Example of drawing a valley chip and an individual luck (see profits), *slide*
- Description of project B: cotton without loan (fallback), *slide*
  - Example of drawing a valley chip and an individual luck (see profits)
- Comparison of outcomes in projects A and B, *slide*
  - Example of drawing a valley chip and an individual luck (compare profits *if* project were chosen A versus profits *if* project B were chosen)
- Play six rounds of low stakes, baseline game (A versus B)
  - Payments are calculated and shown to subjects
- Play six rounds of high stakes, baseline game (A versus B)
  - Payments are calculated and shown to subjects
- Description of project C: cotton with loan and index insurance, *slide*
  - A salient feature: no default loans under *any* covariate shock or idiosyncratic shock
  - Example of drawing a valley chip and an individual luck (see profits)
- Comparison of outcomes in projects A, B, and C, *slide*
  - Example of drawing a valley chip and an individual luck (compare profits *if* project were chosen A versus profits *if* projects B or C were chosen)

- Play six rounds of low stakes, insurance game (A versus B versus C)
  - Payments are calculated and shown to subjects
- Play six rounds of high stakes, insurance game (A versus B versus C)
  - Payments are calculated and shown to subjects
- End of Farming Experiments

Appendix C. Tables

Table C.1 Summary Statistics

Variable	Mean	Std. Dev.	N
Dependent variable			
Insured loan take-up rate (high stakes)	0.57	0.49	378
Demographics and Education			
Age (years)	54.9	13.3	367
Aged less than 40	0.14	0.35	367
Aged between than 40 and 50	0.19	0.39	367
Aged between than 50 and 60	0.33	0.47	367
Aged over 60	0.33	0.47	367
Female (Yes=1)	0.27	0.44	367
Education (years)	6.33	4.11	365
Illiterate	0.05	0.23	365
Some primary school	0.51	0.50	365
Some secondary school	0.34	0.47	365
Completed higher than secondary school	0.09	0.29	365
Financial literacy indicator[1]	0.54	0.20	378
Agriculture and Assets			
Farming experience (years)	23.9	12.7	368
Size of owned agricultural plot (hectares)	6.03	5.57	367
Size of sown land (hectares)[2]	5.01	4.13	365
Cotton yields (quintals per hectare)[2]	46.8	14.8	293
Self-reported value of owned ag plot (000 Soles)	7.43	8.78	307
Self-reported value of house (000 Soles)	15.92	21.0	321
Self-reported value of assets (000 Soles)[3]	20.42	21.8	362
Networks and Credit			
Talked to somebody in her "valley" about farming(Yes=1)	0.67	0.47	378
Number of "valley" members in her agricultural network	1.73	1.61	378
Has ever been a local authority (Yes=1)	0.39	0.49	365
Belongs to a farmer association (Yes=1)	0.29	0.46	364
Got credit for farming activities (Yes=1)[2]	0.61	0.49	378
Got formal credit (Yes=1)	0.39	0.49	232
Got credit from cotton mills (Yes=1)	0.27	0.45	232
Experimental Variables			
Risk rationed (Baseline Game) (Yes=1)	0.24	0.43	378
Risk parameter estimate, EUT[4]	0.45	0.29	365
Risk parameter estimate, CPT[4]	0.74	0.32	365
Probability weighting parameter estimate, CPT[5]	0.54	0.21	365
Overweighting small probabilities (Yes=1), CPT[5]	0.80	0.40	365
Drew two black chips,last low-stake rounds Insurance Game	0.02	0.13	378
Winnings from low stakes Insurance Game (Soles)	3.04	0.85	378

[1] Indicator calculated using knowledge of insurance and loan project, as well as a self-reported degree of comprehension. [2] It refers to the 2007-2008 farming season. [3] *Wealth* includes the values of land & house.
[4] EUT (CPT): Risk estimate assuming Expected Utility Theory (Cumulative Prospect Theory).
[5] Overweighting means that the probability weighting parameter is less than or equal to 0.7.

Table C.2: Summary Statistics by Project Choice in Final Unconstrained Round
Baseline Game

Name	Uninsured Loan (A)			Fallback (B)			*T-Test*
	Mean	S.D.	N	Mean	S.D.	N	(A)=(B)
Demographics and Education							
Age (years)	54.6	0.80	278	55.9	1.39	89	-0.80
Young (age $<$ 40)	0.14	0.02	279	0.12	0.04	89	0.48
Middle (age: [50-60])	0.34	0.03	279	0.33	0.05	89	0.19
Old (age $>$ 60)	0.33	0.03	279	0.36	0.05	89	-0.57
Female	0.24	0.03	279	0.36	0.05	89	-2.15**
Education (years)	6.35	0.25	279	6.27	0.45	86	0.17
Illiterate	0.05	0.21	279	0.09	0.29	86	-1.37*
Some primary school	0.51	0.50	279	0.50	0.50	86	0.20
Some secondary school	0.35	0.48	279	0.30	0.46	86	0.85
Higher than second. school	0.09	0.29	279	0.10	0.31	86	-0.40
Financial literacy indicator	0.55	0.20	286	0.51	0.20	92	1.49*
Agriculture and Assets							
Farm experience (years)	23.4	12.6	279	25.4	13.1	89	-1.27
Size of owned land (Has)	6.28	0.36	278	5.24	4.17	89	1.85**
Size of sown land (Has)[1]	5.23	4.15	277	4.32	4.02	88	1.83**
Cotton yields (QQ/ Ha.)[1]	47.4	14.4	230	44.8	16.2	63	1.12
Land value (000 Soles)	7.64	9.39	235	6.76	6.42	72	0.91
House value (000 Soles)	15.44	19.65	241	17.35	24.32	80	-0.63
Wealth (000 Soles)	20.14	20.84	274	21.30	24.83	88	-0.40
Networks and Credit							
Belongs to ag network	0.71	0.45	287	0.56	0.50	91	2.56***
# members in ag network	1.82	1.60	287	1.44	1.62	91	1.97**
Has been local authority	0.40	0.49	277	0.35	0.48	88	0.88
Belongs to farm association	0.27	0.45	277	0.36	0.48	87	-1.47*
Got credit for farming activities	0.66	0.48	286	0.48	0.50	92	3.01***
Got formal credit	0.36	0.48	188	0.50	0.51	44	-1.71**
Got credit from a cotton mill	0.31	0.46	188	0.14	0.35	44	2.76***
Experimental Outcomes							
Risk estimate under EUT[2]	0.44	0.30	280	0.46	0.29	85	0.48
Risk estimate under CPT[2]	0.73	0.33	280	0.77	0.31	85	0.92
Prob. weighting parameter est., CPT	0.54	0.21	280	0.52	0.20	85	0.81
Overweighting small probabilities, CPT[3]	0.78	0.42	280	0.87	0.34	85	-1.86**
Drew two black chips, low-stake rounds[4]	0.02	0.13	287	0.01	0.10	91	0.43
Winnings, low stakes Insurance Game[5]	3.07	0.88	287	2.96	0.73	91	1.07

* (**) [***]: Significant at 10% (5%) [1%] level. *T-test* assumes unequal variances.
[1] It refers to the 2007-2008 farming season.
[2] EUT (CPT): Risk estimate assuming Expected Utility Theory (Cumulative Prospect Theory).
[3] Overweighting means that the probability weighting parameter under CPT is less than or equal to 0.7.
[4] In last two low-stake rounds of Insurance Game. [5] Expressed in Soles.

Table C.3: Summary Statistics by Project Choice in Final Unconstrained Round
Insurance Game

Name	Insured Loan (C)			Uninsured Loan (A)			*T-Test*	Fallback (B)			*T-Test*
	Mean	S.D.	N	Mean	S.D.	N	(C)=(A)	Mean	S.D.	N	(C)=(B)
Demographics and Education											
Age (years)	53.8	13.2	210	56.0	56.5	124	-1.51*	57.9	14.6	33	-1.53*
Young	0.15	0.36	211	0.13	0.34	124	0.56	0.09	0.29	33	1.07
Middle	0.35	0.48	211	0.31	0.46	124	0.83	0.33	0.48	33	0.19
Old	0.29	0.45	211	0.37	0.49	124	-1.44*	0.45	0.51	33	-1.72*
Female	0.26	0.44	211	0.26	0.44	124	0.05	0.33	0.48	33	-0.82
Education (years)	6.8	4.1	210	5.8	4.1	122	2.08**	5.6	3.9	33	1.61*
Illiterate	0.04	0.20	210	0.07	0.25	122	-0.87	0.12	0.33	33	-1.32*
Some primary school	0.47	0.50	210	0.58	0.50	122	-2.03**	0.52	0.50	33	-0.51
Some second.school	0.39	0.49	210	0.27	0.45	122	2.19**	0.30	0.47	33	0.94
> second.school	0.10	0.31	210	0.08	0.28	122	0.70	0.06	0.24	33	0.94
Financial literacy	0.56	0.19	216	0.51	0.21	129	2.09**	0.50	0.22	33	1.46*
Agriculture and Assets											
Farm experience[1]	23.4	12.7	211	24.2	12.1	124	-0.53	26.0	14.9	33	-0.93
Size, owned land[2,3]	6.1	6.3	210	6.3	4.8	124	-0.35	4.9	3.1	33	1.69**
Size of sown land[2,3]	5.05	4.2	210	5.2	4.0	123	-0.41	3.8	4.2	32	1.53*
Cotton yields-QQ/Ha[2]	47.9	15.2	163	46.3	14.7	106	0.89	41.9	11.5	24	2.31**
Land value[4]	7.73	10.90	173	7.30	5.01	107	0.44	6.08	4.07	27	1.44*
House value[4]	18.65	25.76	185	12.37	16.48	108	2.93***	11.48	9.52	28	2.75***
Wealth[4]	23.13	26.66	207	17.08	12.34	124	2.80***	15.67	10.86	31	2.78***
Networks and Credit											
Belongs to agricult. network	0.69	0.46	216	0.70	0.46	129	-0.15	0.48	0.51	33	2.18**
# members netwk	1.75	1.58	216	1.82	1.65	129	-0.42	1.27	1.63	33	1.56*
Has ever been a local authority	0.39	0.49	209	0.36	0.48	124	0.53	0.50	0.51	32	-1.12
Belongs to a farm association	0.30	0.46	208	0.27	0.45	124	0.56	0.28	0.46	32	0.25
Got credit	0.59	0.49	216	0.70	0.46	129	-2.00**	0.42	0.50	33	1.88**
Formal credit	0.41	0.49	128	0.38	0.49	90	0.42	0.21	0.43	14	1.58*
From cotton mill	0.27	0.44	128	0.27	0.44	90	-0.02	0.43	0.51	14	-1.14
Experimental Outcomes											
Risk rationed[5]	0.24	0.43	216	0.16	0.36	129	1.98**	0.58	0.50	33	-3.64***
Risk estimate EUT	0.42	0.29	210	0.47	0.29	122	-1.59*	0.51	0.30	33	-1.53*
Risk estimate CPT	0.71	0.33	210	0.78	0.32	122	-1.85**	0.79	0.28	33	-1.56*
Prob.weighting param.	0.55	0.21	210	0.52	0.21	122	1.43*	0.51	0.18	33	1.38*
Overweight low prob.[6]	0.78	0.41	210	0.81	0.39	122	-0.67	0.88	0.33	33	-1.52*
Drew two black chips[7]	0.005	0.07	216	0.03	0.17	129	-1.65*	0.03	0.17	33	0.84
Winnings, low stakes[8]	3.11	0.79	216	3.06	0.95	129	0.48	2.58	0.63	33	4.31***

* (**) [***] Significant at 10% (5%) [1%] level. *T-tests* assume unequal variances.

[1] Units are years. [2] For farming season 2007-2008. [3] In hectares. [4] Units are thousand Soles. [5] In the Baseline Game.[6] Overweighting means that the probability weighting parameter is less than 0.7.

[7] In last two low-stake rounds Insurance Game. [8] In low stakes Insurance Game(expressed in Soles).

Appendix D. Surveys

D.1 Entry Survey

I. General Information

1. Name
2. Gender
3. What is your age?
4. How many children younger than 15 years of age currently live in your household?
5. How many completed years of education do you have?
6. The person with the most education in your household, how many completed years of education does he or she have?
7. How many years have you dedicated to agricultural activities?
8. How many hectares does your household own?
9. How many hectares did you work in the past year?
10. How much do you think you would have to pay to rent a hectare of land with similar characteristics to those of your principal cotton parcel?

Row by row, mark with an X the space that corresponds to the subject's answer.	11.1 Did you plant cotton in the years (…)?		11.2 What were your cotton yields in the years ()? (QQ x Ha)	11.3 Do you believe that your cotton yields in the years () were () than those of other farmers in your neighborhood?			11.4. In the years (…), did you…									
							A. Become sick or injured?		B. Suffer any kind of theft? (Seeds, cotton, pesticides, etc.)		C. Suffer a problem with the climate?		D. Suffer an infestation or blight in your cotton crop?		E. Have problems with the irrigation infrastructure in your area?	
	yes	No		Higher	Equal	Less	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
2007-2008																
2006-2007																
2005-2006																

12. During the past 5 years, did you receive any type of technical assistance (TA) or training (T) related to the production of cotton?

If no, continue to question 14. If yes, continue to 13.

13. Describe the last two TA or T that you received?

	From whom did you receive the TA or T? *>> Table 1*	The TA or T was? *>> Table 2*
TA 1		
TA 2		
T 1		
T 2		

Table 1
1. Cotton gin
2. Other private business
3. NGO
4. Ministry of Agriculture
5. Other? Who?__________
____
____

Table 2
1.Very beneficial
2. beneficial
3. Somewhat beneficial
4. Not beneficial

II. Social Capital

14. Are you or have you ever been any kind of authority of some association, in your community, or irrigation commission?

15. Do you currently belong to any association of farmers?

III. Insurance

Row by row, mark with an X the space that corresponds to the subject's answer.	16.1 Do you know what () insurance is? *yes, quest.* ***16.2*** *No, quest.* ***16.3***		16.2 Do you have to pay for (…) insurance?			16.3 Do you or does anyone in your household have (…) insurance? *yes, Q.* ***16.4*** *No, Q.* ***16.5***		16.4 If so, does this person pay for the (…) insurance?		16.5 Do you know who delivers the services of () insurance?				16.6 Only if they respond YES to question **16.1** Do you know what benefits you receive from (…) insurance? *(Table 3)*
	Yes	No	Yes	No	Doesn't know	Yes	No	Yes	No	The public sector	The Caja rural or a bank	Insurance company	Do not know	
Health														
Accidents														
Life/burial/ funeral														
Debt														
Other? Which?														

Table 3

1. Free or less expensive medical attention in case of an accident

2. Gives my family money should I pass away.

3. Medical attention in a hospital

4. Pays my debts if I pass them to my next of kin

5. Pays for my burial and/or funeral,

17. Would you be interested in paying a monthly premium to an institution in exchange for receiving a payment ONLY in the case that you:

__ Are ill or injured

__ Suffer an infestation or blight in your crops

__ Suffer a problem with the climate (e.g., drought)

__ Suffer problems with the irrigation infrastructure

D.2 Exit Survey

I. Networks

1. How many people in the group in which you are seated do you know? ___

2. How many people in the group have you spoken with about farming activities (e.g., what to plant, input use, etc.)? ___

II. Assets

3. The house in which you live is

___ Owned by you ___Owned by your parents/in-laws ___Owned by others ___Rented (if rented, continue to question 5)

4. How much do you think you would have to pay to buy a house similar to yours?

Amount ______Soles

5. Do you possess one of the following consumer goods?

___Car or light truck ___Motorcycle ___Heavy truck ___Tractor

III. Credit

6. If you applied for a loan at the local urban or rural Caja or a bank, do you think they would give it to you?

7. If you applied for a loan at a cotton gin, do you think they would give it to you?

8. If you applied for a loan from an informal moneylender, do you think they would give it to you?

9. In the years 2007-2008, did you obtain a loan in order to pay for your costs of production? ___

(If no, continue to question 11)

10. From whom did you obtain this loan?

___Bank or Caja ___Cotton gin ___Informal lender

IV. Agricultural Insurance

11. Do you think that the instructions we gave you today prior to today's activities were:

__Very difficult __Difficult __Easy __Very easy

12. Do you remember what happened if you obtained a loan without insurance and could not repay the loan? ____

What happened?______

13. The indemnification that the insurance paid you depended on the average yields in the valley? ____

14. Did it depend on individual luck? ____

15. If someone were to offer you insurance similar to what we saw in activity 1 for the next agricultural year, would you be interested in buying it? ____

16. Would you be interested in paying XX Soles per hectare for insurance similar to what we saw in activity 1 (i.e., farming experiments)?

( ) YES >> *Mark with an X the maximum he/she would be willing to pay*		**( ) NO** >> *Mark with an X the maximum he/she would be willing to pay*	
S/. XX+25		S/. XX-25	
S/. XX+50		S/. XX-50	
S/. XX+75		S/. XX-75	
S/. XX+100		S/. XX-100	
More		less	

XX was set at 100, and 150, and 200 Soles.