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Willingness-to-pay for microinsurance and flexibility: Evidence from an agricultural investment lab-in-the-field experiment in Senegal

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Abstract

Both researchers and practitioners increasingly recognize the importance of interacting savings, credit and insurance as risk coping tools for agricultural smallholders in developing countries. We (K. Czura, A. de Janvry, V. Dequiedt and E. Sadoulet) collaborated with the holistic risk reduction program *R4 Senegal* to study the impact of insurance on agricultural decision making and the willingness-to-pay for insurance in the presence of other financial instruments in original lab-in-the-field experiments. Preliminary analyses suggest (a) little over proportional effects of insurance on investment decisions and (b) some complementarity among different financial instruments, confirming the rising awareness among researchers and practitioners that a holistic approach to risk resilience is needed.

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▶ Context

Poor households depending on agro-pastoral livelihoods have seasonal income and are therefore particularly vulnerable to idiosyncratic income shocks. Additionally, weather-related aggregate shocks such as droughts or floods pose huge threats to vulnerable households who have no means of diversifying their income sources or investing in risk-reduction technologies.

R4 Senegal is a unique project led by the United Nations World Food Program in collaboration with Oxfam America that strives to address all aspects in which poor households may be affected by risks, in particular climate shocks, and to combine various risk mitigation and coping strategies. These are summarized in four categories as risk taking (credit), risk transfer (insurance), risk reserves (savings), and risk reduction in the form of communal asset creation.

This holistic idea to build resilience, decrease vulnerability, and establish proper risk sharing and risk transfer mechanisms is novel and innovative. In part, it is an answer to the failure of independent risk transfer mechanisms reflected in the low offer of insurance products for aggregate risks in developing countries as well as the low take-up of these insurance products when they are available in form of index-based contracts. Very recent research suggests that the interaction between credit, savings and insurance is important for household behavior (*Karlan and Morduch* 2009). Also the interaction between informal risk sharing groups and formal insurance seems to play an essential role in households' demand for and use of insurance (*de Janvry, Dequiedt & Sadoulet 2013*, *Janssen & Kramer 2012*, *Mobarak and Rosenzweig 2012*). However, little is known on both questions and empirical evidence remains limited.

▶ Research project

The present research project was conducted in cooperation with the holistic risk management approach within the *R4 Senegal program*. While credit and savings programs within the *R4 program* are partly in place in the target region of Tambacounda in Senegal, risk transfer products and risk reduction projects are currently being developed for the district of Koussanar. Contributing to the risk transfer product development, the research project comprised the study of (1) the risk profile of households using household surveys and (2) the determinants of the households' demand for insurance using experimental games in lab-in-the-field experiments. Our local partner for this project was Gaston Berger University of Saint-Louis.

For both studies, 400 agricultural households were randomly selected in the target district of Koussanar from 12 treatment villages where the *R4 program* will be implemented and 16 comparison villages that will not be exposed to the *R4 program*. In the first study, households were surveyed on their agricultural decisions, their vulnerability to agricultural shocks and their applied coping strategies for hardships. Since the households' structure is rather complex in this region, several household members, including the head of the household, can be considered as decision-makers with respect to agricultural and financial decisions.

In the second study, we conducted lab-in-the-field experiments, also known as framed field experiments, with the same 400 households. In each of these, we invited the decision-maker answering questions in the survey to participate in one experimental session. The experimental sessions comprised 20 participants each and lasted the whole day. Transportation and meals were organized by our local team. In the experimental sessions the potential insurance clients played decision making games that resemble specific characteristics of agricultural

investments and insurance. All decisions were incentivized by monetary payoffs that the participants may earn in the experimental games depending on their decisions and some random components. This is necessary to truthfully elicit their preferences or their private information. Expected payoffs are comparable to average daily wage earnings so that the stakes in the game are well incentivized.

▶ The experimental design

The specific objectives of the experiments are to study the impact of insurance on investment decisions and the interactions between flexibility and insurance. In the context of agricultural decision making, flexibility refers to the ability to take decisions once relevant information is available, e.g. the ability to choose crops once information on future prices is precise, the ability to decide whether or not to use fertilizers once it has become clear that insects will not attack the crop, or the ability to decide how much to invest in cattle once the revenue from harvest is precisely known. In this regard, flexibility or non-flexibility in agricultural decision making may interact with insurance.

The insurance product that the *R4 program* aims at introducing is a weather index-based policy. It provides coverage against weather shocks by offering payoffs whenever rainfalls are below a given threshold. It will come in addition to various other risk-coping instruments, such as savings and credit, and will help to build a comprehensive safety net. In parallel to the insurance product, the R4 program partners are encouraging savings and credit through savings groups and are helping populations become more resilient to climatic risk by various community projects that reduce the exposure to weather shocks. The existence of savings and credit programs in the area suggest that households are committed, or will be commit-

ted, to various financial transactions that come on a regular basis: credit installments or savings plans.

In this context, flexibility can be considered as a proxy for non-commitment. The more the household is committed to credit reimbursement or savings plans, the less flexibility it has on its financial or investment decisions. While commitment to credit reimbursement or savings plans is typically a dynamic concept that is difficult to capture in a one-stage framework, it is easy to introduce different levels of flexibility in a one-period game. We use non-flexibility in decision making as a proxy for commitment in various financial products. By this we circumvent problems related to identification of effects in dynamic experimental setups, such as undesirable learning or path-dependency, while still being able to study interesting aspects of the interactions among different financial products in a compact framework.

The experimental design is built around a basic investment decision setting. Participants face an investment opportunity with risky prospects. From their initial endowment y, they can invest an amount x in a risky asset. This amount is lost with probability one-half or multiplied by three with probability one-half. The expected rate of return on the investment is therefore 50 percent but the final wealth can be very low if the participants invest a large share of their wealth in the risky asset. In addition to the return on investment, there is a second stochastic element in the experimental setting. The participants' initial wealth can be high ($\bar{y}$) or low ($\underline{y}$) with equal probability. This reflects the fact that investment decisions depend on income, consequently on the annual harvest of agricultural production which can be good or bad depending on the weather conditions.

2-decisions and 1-decision scenarios

The participants must decide how much to invest in the risky asset according to two distinct scenarios. In the first scenario, the 2-decisions scenario, the participant knows the value of y, his initial wealth, before deciding how much to invest. The participant therefore takes two investment decisions, one in the good harvest case $y = \bar{y}$, and one in the bad harvest case $y = \underline{y}$. In the second scenario, the 1-decision scenario, the participant must decide how much to invest in the risky asset before he knows the realized-value of y. The participant therefore takes only one investment decision. The 2-decisions scenario is the flexible scenario, while the 1-decision scenario is the non-flexible scenario resembling commitment.

Standard and insurance treatments

We then apply different treatments to these scenarios. Across treatment we vary the variability in y, the initial wealth, from a standard deviation of five in the standard treatment S, to three in the first insurance treatment I1 and to one in the second insurance treatment I2 while keeping the expected wealth level constant. Reducing the variability in y resembles the basic mechanism of insurance and aims at capturing the effect of insurance on investment decisions.

Willingness-to-pay

After the participants have taken the investment decisions related to the different scenarios, a second phase of the experiment consists of eliciting the participants' willingness-to-pay using a standard Becker-deGroot–Marschak (1964) procedure.

Two types of willingness-to-pay are obtained. The first type is how much participants are willing to pay for insurance, i.e. how much they are willing to pay to switch from a standard treatment in which the variability of initial wealth is high to an insurance treatment in which the variability of initial wealth is low. Participants are asked to reveal this information for the two different scenarios, the 2-decisions scenario and the 1-decision scenario. We denote this as *WTP for insurance*. The second type of elicited willingness-to-pay concerns the benefits of flexibility. Participants are asked to reveal how much they are willing to pay to switch from a 1-decision scenario to the corresponding 2-decisions scenario. We denote this as *WTP for flexibility*.
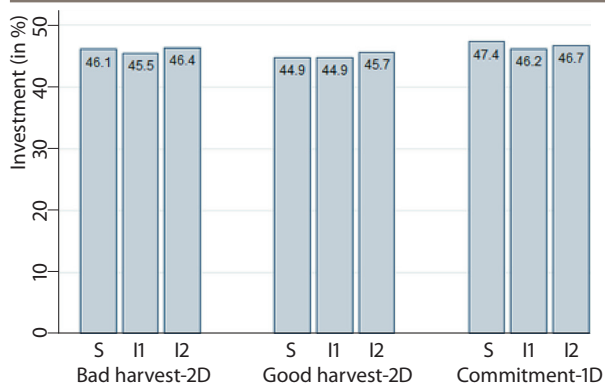
This protocol allows us to compare *WTP for insurance* in environments characterized by different levels of flexibility. Further, it also allows us to compare *WTP for flexibility* in environments characterized by various levels of insurance.

▶ Preliminary results

We find that participants invest 45.96 percent of their initial wealth in the risky asset. Figure 1 depicts the investment shares of initial wealth invested in the risky assets graphically by decision scenario (bad harvest and good harvest investment decision in the 2-decisions scenario, and one single investment decision in the 1-decision commitment scenario). Within one decision making scenario, the share of wealth invested does not change significantly across the three treatments. While insurance increases investment in the low income state proportionally to the income increase by insurance in this state, it also decreases investment in the high income state proportionally to the income decrease in this state. This implies that the provision of insurance as modeled by the reduction in variability of the initial wealth has no significant over proportional impact on investment decisions.

Figure 1

Investment share (in %) of total wealth
by decision and treatment

Table 1

WTP for flexibility and insurance				
	WTP for flexibility (1)	WTP for insurance-flexibility (2)	WTP for insurance-no flexibility (3)	WTP for insurance (4)
Insurance I1	0.132 (0.088)			
Insurance I2	0.056 (0.087)	0.092 (0.076)	0.074 (0.073)	0.083 (0.052)
Commitment - dummy				0.121* (0.062)
Constant (S in (1), I1 in (2)-(4))	1.812*** (0.085)	1.165*** (0.081)	1.295*** (0.080)	1.170*** (0.075)
R-squared Observations P-value t-test A2 vs. A4	0.001 1179 0.369	0.001 786	0.001 786	0.002 1572

Notes: Dependent variable: Willingness-to-pay for flexibility and insurance, elicited by a Becker-deGroot-Marschak mechanism. Price range for WTP is 0 to 5. Standard errors in parentheses and clustered at the individual participant level. * p < 0.10, ** p < 0.05, *** p < 0.01.

The different measures for willingness-to-pay for insurance and flexibility are set out in Table 1. The average willingness-to-pay for flexibility in the standard treatment is 1.8 on a discrete scale from zero to five. There is no significant difference in the *WTP for flexibility* for neither insurance treatment (column 1). The willingness-to-pay for insurance is around 1.2 on average on a discrete scale from zero to five. There is no significant difference between the willingness-to-pay for the moderate-coverage insurance level I1 and the high-coverage insurance level I2, neither in the flexible non-commitment decision scenario (column 2) nor in the non-flexible commitment scenario (column 3).

In column 4 we isolate the effect of commitment on the willingness-to-pay for insurance and we find a marginally significant increase of 0.121 translating to an increase of around ten percent in the willingness-to-pay due to commitment. This implies that for potential insurance clients the value of insurance is higher when combined with other financial products that involve some form of commitment.

▶ **Concluding remarks**

While in our lab-in-the-field experiments insurance has been successful in increasing investment in the low income state, no over proportional impact on investment aside from the effect induced by the reduced variability in income has been found. This may indicate the limited suitability of insurance as an investment promotion tool and may lead to further research on the two different roles of insurance of investment promotion and safety net provision. Willingness-to-pay for insurance in general seems not to depend much on insurance coverage, although the value of insurance is higher in non-flexible investment decisions. As a next step, we will look in more detail at heterogeneous effects across individuals in terms of risk preferences and household characteristics to better understand the determinants of the insurance's value.

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