Discontinuity of Preferences and Insurance Demand: Results From a Framed Field Experiment in Burkina Faso

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Abstract

In this paper, we present a novel way to understand the low uptake of index insurances using the concept of discontinuity of preferences. We run a framed field experiment with cotton farmers in SouthWest Burkina-Faso to test whether farmers respond differently to two actuarially identical contracts, but framed in a way where only one allows for uncertain premium. We test whether the attitude to respond differently to these contracts can be explained by discontinuous preferences. In this sample, 29% of the surveyed farmers reveal themselves both to have discontinuous preferences and to be willing to pay more for an insurance contract framed with uncertain premium. Our results highlight the importance of designing insurance contracts allowing for discontinuous preferences.

Keywords: Index Insurance, Risk and Uncertainty, Discontinuity of preferences, Field Experiments

1 Introduction

Despite a decade of effort to promote index insurance as a tool for poverty reduction in developing countries, the take up of the index insurance product remains unexpectedly low (Gine and Yang, 2007; Cole et. al 2010). In the last years, a growing body of research has tried to understand how the individual

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decision making under risk can affect the agricultural insurance demand (Gine et al 2008, Elabed and Carter 2014).

This paper tried to understand whether discontinuity of preferences can affect the agricultural insurance take up. The intuition is coming from the observation that farmers seems worried by the certainty of having to pay an insurance premium in all states of the world. Comments are of the form of "you mean I have to pay the premium even when there is a drought" . We think that this attitude reflects the possibility that farmers associate a special weight to the payment of the premium. In particular, the effect of discontinuous preferences on insurance demand can be driven by the certainty to pay the insurance premium in all state of the world, while the other component of the insurance contract remain uncertain. It follows that people could apply a utility function to the payment of the premium different from the one they use to evaluate the other part of the insurance contract.

Using data from a framed field experiment conducted in Western Burkina Faso, during the baseline data collection for the I4 (Index Insurance Innovation Initiative) cotton insurance project[1], we test whether cotton farmers respond differently to two actuarially identical contracts, but framed in a way where only one allows for uncertain premium. We test whether the attitude to respond differently to these contracts can be explained by discontinuity of the preferences.We find that 29% of the farmers with discontinuous preferences prefer insurance contracts with uncertain premium.

This paper is related to a few separate lines of research. First it contributes to a growing list of empirical studies that attend to bring additional insights to the study of the insurance demand. At this regard, Elabed and Carter (2014) used a framed field experiment in Mali to show that compounded risk aversion decreases the demand of insurance between cotton farmers relative to what it would be if individuals had the same degree of risk aversion but were compounded risk neutral. Previous studies have investigated other factors for the uptake of the index insurance such as lack of financial knowledge (Gine et al. 2008); lack of trust (Cole et al. 2010); liquidity constraints (Carter et al. , 2011).

Another related work belongs to the studies of decision making under risk. At this regard, Andreoni and Sprenger (2009) experimentally test a model of discontinuous preferences over certain and uncertain outcome, already introduced by Schmit (1998), suggesting that violation of expected utility theory in the neighborhood of certainty can be explain by discontinuous preferences. They apply then the concept of discontinuous preferences to experimentally show that subjects exhibit preferences for certainty when it is available, but behave largely as discounted expected utility maximizer away from certainty (Andreoni and Sprenger, 2012).

We introduce the concept of discontinuity of preferences to explain the in-

[1] This insurance is an innovative multi scale index insurance contract that reduces basis risk relative to conventional, single-scale index insurance contract. The insurance will be sold this year in the provinces of Tuy and Bale where we already run the baseline survey and the experiment.

surance take up, providing evidences that discontinuous preferences can have an effect on the insurance demand and, in turn, on the welfare of the farmers.

The paper proceeds as follows: Section 2 presents a conceptual framework analyzing the discontinuity of preferences in the insurance context. Section 3 describes our experimental design and the Section 4 the results. Section 5 presents a discussion of the results. And Section 6 concludes.

2 Conceptual framework

The goal of this section is to introduce a theoretical framework to explore the relation between discontinuous preferences over certain and uncertain outcomes and insurance demand. In particular we examine how the introduction of an alternative insurance contract that involves an uncertain premium may increase insurance demand for agents with discontinuous preferences.

2.1 Insurance Demand under Expected Utility Theory and Discontinuity of Preferences over Certain and Uncertain Outcomes

To motivate our experimental design, we briefly analyze the decision to buy an insurance contract of two farmers. The first farmer is a standard expected utility maximizer while the second farmer has discontinuous preferences over certain and uncertain outcomes.

We assume that farmers have no other sources of income than his stochastic cotton revenue. We assume there are two states of the world. In particular, with probability p_b yields are low and farmers earn a revenue y_b, and with probability $1-p_b$ yields are high and farmers earn a revenue y_g .The preferences of the first farmer are captured by a concave Von Newman Morgenstern Utility function $u(.)$.The preferences of the second farmer are discontinuous, whereby certain outcomes are evaluated with a utility function $v(.)$ while uncertain outcomes are evaluated with $u(.)$. To fix our idea, we follow Anderoni and Sprenger (2009; 2012) and set $v(x) = x^{\alpha}$ and $u(x) = x^{\alpha-\beta}$ with $0 \leq \beta < \alpha < 1$. With these notations, β can be interpreted as the penalty associated with uncertain outcomes. We further assume that the farmers utility in a given state of the world is additively separable in its certain and uncertain elements. In this context farmers may buy an insurance contract to insurance themselves against the risk of bad yields and to smooth consumption.

In the insurance contracts we will not consider any time dimension, since the insurance premium is simply paid after the harvest[2] We will start our analysis considering a classical indemnity insurance contract.

Demand for a traditional insurance contract We first consider a simple insurance contract that involves a premium π and an insurance payment I in

[2]Cotton producers in Burkina Faso take joint credits to buy the inputs at the beginning of the cotton season and the reimburse them after the harvest.

the bad state of the world. Farmers buy this contract if and only if they reach a higher level of utility with the insurance than without. Both farmers reach the same utility without insurance since they simply consume their initial monetary endowment, w and their stochastic income. It follows that the objective functions for the two farmers without an insurance contract is the following:

$$EU_{NI} = p_b u(w + y_b) + (1 - p_b)u(w + y_g)$$

In contrast, the two farmers evaluate differently the insurance contract.

In particular, the utility for a standard expected utility maximizer subscribing an insurance contract results as follows:

$$EU_I = p_b u(w + y_b + I - \pi) + (1 - p_b)u(w + y_g - \pi)$$

It follows that if the individual yields are bad, the insurance triggers a payout, I, resulting in an income equal to the initial monetary endowment, plus the net income under bad yields, less the insurance premium, plus the value of the indemnity, $w + y_b - \pi + I$. If the individual experiences good yields, there is not a payout coming from the insurance and the resulting income will be equal to the initial monetary endowment, w, plus the net income under good yields, less the insurance premium, $w + y_g - \pi$.

For the farmer with discontinuous preferences, part of the income stream is now certain. In other words, the insurance premium, π, is paid for sure while the indemnity, I, is received only in the bad state. His utility results then as follows:

$$W_{I,A} = p_b[u(y_b + I) + v(w - \pi)] + (1 - p_b)[u(y_g) + v(w - \pi)]$$

that is

$$W_{I,A} = p_b[(y_b + I)^{\alpha-\beta} + (w - \pi)^{\alpha}] + (1 - p_b)[(y_g)^{\alpha-\beta} + (w - \pi)^{\alpha}]$$

Let's now consider an alternative insurance contract where we introduce the uncertainty about the payment of the premium.

Demand for an alternative insurance contract: uncertainty about the payment of the premium Consider an alternative insurance contract that involves the same premium π but, in this case, π is only paid in the good state of the world. The new indemnity $I' = I - \pi$ is received in the bad state of the world. Note that this contract involves exactly the same net income flows as the classic contract: in the good state an insured farmer consumes $w + y_g - \pi$, in the bad state he consumes $w + y_b + I' = w + y_b + I - \pi$. As a result the expected value of this alternative contract is identical to the expected value of the classic contract for an expected utility maximizer. But this does not hold for a farmer with discontinuous preferences. In particular, since the premium is now uncertain, an agent with discontinuous preferences will use the same function $u(.)$ to evaluate both the payment of the premium and the indemnity. The utility with insurance becomes as follows

$$W_{I,B} = p_b[u(y_b + I') + v(w)] + (1 - p_b)[u(y_g - \pi) + v(w)]$$

that is

$$W_{I,B} = p_b[(y_b + I')^{\alpha-\beta} + w^{\alpha}] + (1 - p_b)[(y_g - \pi)^{\alpha-\beta} + w^{\alpha}]$$

It follows that a farmer with discontinuous preferences over certain and uncertain outcome would prefer a contract framed with uncertain premium to a traditional one since he will discount the premium by the β coefficient, implying, in turn, less disutility than in a classic insurance contract. In contrast an expected utility maximizer will be indifferent between the two insurance contracts.

The main testable implication of the model will be the following

Hypothesis 1. *An agents with discontinuous preferences over certain and uncertain outcome will prefer a contract framed with uncertain premium.*

In order to test the hypoyesis above, we design an experiment that allows to elicit farmers' demand for a classic insurance contract and an alternative one involving an uncertain premium. Specifically we randomize the contract proposed to farmers and compare their average WTP under a classic and alternative contract. In addition we adapt Andreoni and Sprenger's games (2009;2012) and use them to identify agents with discontinuous preferences in order to test whether these agents are responding more favorably to the alternative contract than standard expected utility maximizer.

3 Experimental design and data

3.1 Experimental Procedure

We run the experiment with 56 cotton cooperatives (GPCs) allocated in 30 villages in the provinces of Tuy and Bale in the Southern-West Burkina-Faso. We end up with a sample of 557 cotton farmers for whom we have individual informations about cotton production, family composition, consumption, education and other individual characteristics. The Table 6.2 in Appendix A1.2 provides the descriptive statistics for the experiment participants.

The cotton cooperatives were randomly selecteded from the list of cooperatives participating at the impact evaluation for the I4 insurance project.Both data collection and experiment took place in January- February 2014. Three rural area animators translated the experimental protocol from French to Doula and More, the local languages, and ensured that it was accessible to a typical cotton farmer. Game trials were conducted with university students in Namur, Belgium and with cotton farmers who were not part of the final experimental sample.

The experiment took place in an open space with at maximum thirteen members of the same cotton cooperative, and they lasted around two and a half hours, not counting the time necessary to distribute the gains.

The experiment was composed by three activities.The first two activities were built in order to elicit risk aversion and to test for discontinuity of preferences.The third activity was built in order to elicit the insurance demand and the willingness to pay for the insurance.

Farmers were paid at the end of the three activities only for one activity randomly selected. In the third activity people were payed only for the willingness to pay game and not for the insurance game. We used this truthful incentive device in order to encourage the players to choose carefully. The animator announced the payment procedure to the players at the beginning of each activity. At the end of the session, participants received their game winnings in cash, in addition to a show up fee of 100 FCFA. Minimum and maximum earnings, excluding show up fee, were 0 FCFA and 3200 FCFA and mean earnings were 1792 FCFA[3]. The daily wage for a male farm labor in the areas where we ran the experiments were around 1000 FCFA.

3.2 The Games

In this section we present the structure of the games. In the first two games used to test for preference discontinuity we randomize the order of the games. In the third game used to elicit the insurance demand and the willingness to pay for the insurance we randomize the insurance frames.[4]

3.2.1 Game 1 and 2: Testing for Discontinuity of Preferences

The combination of the outcomes of the first two games enables to identify players with discontinuous preferences. The general idea is to compare players behavior when they are asked to choose between two risky lotteries (game 1) to their behavior when they are asked to choose between a risky and a safe lottery (game 2). The basic intuition is that players with discontinuous preferences exhibit a disproportionate preference for the degenerated lottery. We first present in details the first two games before precisely describing how outcomes are used to distinguish expected utility maximizer from agents with discontinuous preferences.

First game_ riskier vs safer lottery In the first game we simply present subjects with a menu of choices that permits measurement of risk aversion. In particular the game is based on eight choices between paired lotteries as described in Table 3.2.1.

Note that for the first two choices, lottery A dominates lottery B as it involves larger pay-offs than lottery B in both states of nature. Starting with the third

[3]The gains exactly correspond to the amounts showed to the player during the games and divided by 100 FCFA.

[4]The Table6.1 in Appendix A1.1 presents the results of the randomization

pair, the player faces a classic risk-return trade-off as lottery A implies a greater expected payoff but a lower payoff in the bad state of the world. As we move from one pair of choices to the next, only the payoff of A in the bad state changes making lottery A less and less attractive to a risk averse agent.

The switching point from the riskier to the safer lottery provides an estimate of subjects' degree of risk aversion. To avoid multiple switching points we ask the subjects to indicate the pair starting from who they would choose lottery B to lottery A. Column (3) of Table 3.2.1 reports the ranges of RRA of players who switch at each pair. In order to compute the coefficients of risk aversion we assume constant relative risk aversion, and we use an utility function $u(x) = \frac{x^{1-\alpha}}{1-\alpha}$. This specification implies risk aversion for $\alpha \geq 1$, risk neutrality for $\alpha = 0$ and risk loving for $\alpha < 0$[5]. The coefficient of risk aversion reported in column(4) in Table3.2.1 is the average of the CRRA ranges.[6]

Note that in this design probabilities are held constant across decision rows and we vary only the lowest outcome of the risky lottery. In other words we use a simple outcome scale game to measure the risk aversion. Design of this sort are very common in the decision analysis and have been used in experimental economics by Schubert et al. (1999), even if it is more common to vary probabilities over decision rows and to hold outcomes constant as in Holt and Laury (2002).Our choice of an outcome scale was motivated by the low literacy of the players: field tests revealed that variations of prizes were more easly understood than variation of probabilities.

The game was implemented using visual aids and examples. In particular, players were facing 8 boxes, one for each of the pairs of lottery. Each box contained two bags, a blue one and a green one. The blue one corresponded to the safer lottery and the green one to the riskier lottery. In each bag there were two balls, one pink, corresponding to the low outcome and one orange, corresponding to the high outcome. We used pair one as an example and indicated that lottery A was undoubtedly superior in that case. We then showed the outcomes of all eight boxes and discussed the tradeoffs in choosing one over another.We then asked the players to indicate the number of the box from which they wanted to switch from the riskier to the safer lottery. Players must individually chose their preferred bags' combination indicating it on a paper reporting all the possible combinations.

Second game_ risky vs degenerate lottery The second game is very similar to the first game, except that a degenerated lottery replace the "safer" lottery, while the ranges of risk aversion are the same as in game 1. Table 3.2 presents the outcomes for each lotterys' pair.

From pair 3 to 8 , the outcome of the degenerated lottery is such that an expected utility maximizer (with CRRA preferences as described above) would choose the same switching pair as in Game 1. In contrast, an agent

[5] When α=1,the natural logarithm is used to evaluate risk preferences.

[6] There is not a coefficient of risk aversion associated to the first two pairs, since lottery A respectively strictly and weakly dominates lottery B.

Pair	Riskier lottery (A)(1)						Safer Lottery(B)(2)						CRRA if switch to B (3)	CRRA (4)	Risk pref (5)
	p	l	$1-p$	h	EV	sd	p	l	$1-p$	h	EV	sd	$\frac{x^{1-\alpha"}}{1-\alpha"}$	$\bar{\alpha}"_i$	
1	1/2	90000	1/2	320000	205000	115000	1/2	80000	1/2	240000	160000	80000			Not EUT
2	1/2	80000	1/2	320000	200000	120000	1/2	80000	1/2	240000	160000	80000			Not EUT
3	1/2	70000	1/2	320000	195000	125000	1/2	80000	1/2	240000	160000	80000	$1.58 < \alpha" < inf$	+inf	Extr RA
4	1/2	60000	1/2	320000	190000	130000	1/2	80000	1/2	240000	160000	80000	$0.99 < \alpha" < 1.58$	1.28	High RA
5	1/2	50000	1/2	320000	185000	135000	1/2	80000	1/2	240000	160000	80000	$0.66 < \alpha" < 0.99$	0.82	Very RA
6	1/2	40000	1/2	320000	180000	140000	1/2	80000	1/2	240000	160000	80000	$0.44 < \alpha" < 0.66$	0.55	RA
7	1/2	20000	1/2	320000	170000	150000	1/2	80000	1/2	240000	160000	80000	$0.15 < \alpha" < 0.44$	0.29	Slight RA
8	1/2	0	1/2	320000	160000	160000	1/2	80000	1/2	240000	160000	80000	$0 < \alpha" < 0.15$	0.075	RN

The CRRA ranges are computed assuming a CRRA utility function of the form $U(x) = \frac{x^{1-\alpha}}{1-\alpha}$ with coefficient of relative risk aversion equal to α. The CRRA range associated to each lottery pairs are computed considering the moment in which the player switches to B . We found the CRRA ranges equalizing the expected utilities. For example, considering the fourth pair, the lower bound of the range is found equalizing the expected utility associated to the fourth pair in lotteryA with the one in lottery B, $EU_A^4 = EU_B^4$, and solving for 0; while the upper bound is found equalizing the expected utility associated to the third pair in lottery A with the expected utility associated to the third pair in lottery B,$EU_A^3 = EU_B^3$,and solving for zero.

Table 3.1: Riskier vs Safer Lottery

with discontinuous preferences over certain and uncertain outcomes could switch earlier in this second game. This is because a player with strong preferences for certainty would attach a special value to the sure alternative. She would thus be willing to give up extra expected return for this alternative, compared to what her risk aversion level would predict. Note that, as in the first game, in the first two pairs, lottery A dominates lottery B. Again the first pair was used as an example. While choosing B over A in the second pair may appear irrational, Gneezy et al. (2006) show that individuals value risky prospects less than its worst possible realization[7]. This attitude can be detect in our games if the player switches at pair two in both games.

As for the other game, we illustrate the eight pairs of the game with eight boxes. Each box a contained two bags, a green one and a red one. The green sack corresponded to the risky lottery and was identical as the green bag of the first game. The red bag corresponded to the degenerate lottery and only contained one yellow ball. The way in which we proceed for the game was exactly the same used in the first game.

3.2.2 Game 3: Insurance games

In the third game we want to compare farmers' demand for a traditional insurance contract and an alternative contract that is actuarially equivalent but involves an uncertain premium. As described in Section 1, our idea is that agents with discontinuous preferences would be willing to pay more for an insurance presented with uncertain premium.

As in the example developped in Section1, the traditional contract involved a premium that had to be paid regardless of the state of the world while the premium in the alternative contract was only paid in the good state. In the bad state the insurance pays an indemnity that is lowered by the amount of the premium in the case of the alternative contract

The third game is composed by two activities. In the first activity we explore whether the demand of insurance is significatively different in presence of two actuarially identical contracts, but framed in a way where only one allows for uncertain premium. In the second activity we show whether the willingness to pay for the insurance is significatively different for the two contracts.

First part: Eliciting Insurance Demand The activity started with a careful description of the stochastic yield realization and the implied revenue for the player who all were endowed with one hectare of land planted in cotton in the game. Afterwards, the participants played three times in a row, which

[7] In particular, they show that the average willingness to pay for a gift certificate of 50$ was 38$, and the average willingness to pay to participate in a lottery with 1/2 probability to receive a gift certificate of 50$ and 1/2 probability to receive a gift certificate of 100$ was 28$. Therefore the willingness to pay for the degenerate lottery was signficatively higher than the willingness to pay for the risky lottery.

Pair		Risky lottery(A)					Degen	CRRA if switch to B	Average CRRA	Risk pref
	p	l	$1-p$	h	EV	sd		$\frac{x^{1-\alpha"}}{1-\alpha"}$	$\bar{\alpha}"_i$	
1	$1/2$	90000	$1/2$	320000	205000	115000	60.000			Not EUT
2	$1/2$	80000	$1/2$	320000	200000	120000	80.000			Not EUT
3	$1/2$	70000	$1/2$	320000	195000	125000	127.200	$1.58 < \alpha" < inf$	+inf	Extrem RA
4	$1/2$	60000	$1/2$	320000	190000	130000	139.000	$0.99 < \alpha" < 1.58$	1.2	High RA
5	$1/2$	50000	$1/2$	320000	185000	135000	146.000	$0.66 < \alpha" < 0.99$	0.82	Very RA
6	$1/2$	40000	$1/2$	320000	180000	140000	150.700	$0.44 < \alpha" < 0.66$	0.5	RA
7	$1/2$	20000	$1/2$	320000	170000	150000	157.400	$0.15 < \alpha" < 0.44$	0.29	Slight RA
8	$1/2$	0	$1/2$	320000	160000	160000	160.000	$0 < \alpha" < 0.15$	0.075	RN

Table 3.2: Risky vs Degenerate

corresponded to three "years". Each year they first decided whether or not to buy insurance and then draw a ball indicating their yield realization. .Before to play the insurance activity the participants learned how to determine their yields and the resulting revenue.

Farmers drew their yield realizations from a bag containing 4 orange balls and 1 pink ball. The orange balls correspond to a good yield, y_g , equal to 1200 Kg/ha, while the pink ball corresponds to a bad yield, y_b , equal to 600 Kg/ha. Considering the historical yield in the area of study, the probability to have a good yield was set at 4/5 and the probability to have a bad yield was set at 1/5.

A player profit without any insurance contract was equal to the cotton revenue minus the input expenses (set to 100.000 FCFA). Cotton price was set to 240 FCFA. Finally players had an initial monetary endowment, w, equal to 50.000 FCFA[8] .

$$profit = py_i - Inputs$$

The Table3.3 presents the revenue components in both states of the world, in the absence of insurance.

	good yield	bad yield
Input	-100.000	-100.000
Cotton Revenue	288.000	144.000
w	50.000	50.000
Total Revenue	238.000	94.000

Table 3.3: Revenues

The insurance contract involved an indemnity paid in the case of a bad yield and a premium, π, which was either payed regardless of the state of nature (traditional frame) or waived in the bad state of nature (alternative frame)[9] In the traditional frame (frame A), the payment of the premium was certain. The indemnity was then set to 50.000 FCFA. In contrast, in the alternative frame (frame B), the payment of the premium was uncertain. The indemnity was then set to 30.000 FCFA. In other words, the net insurance payment (indemnity - premium) was the same under both frames. Table 3.4 summarizes the contract terms under both frames.The premium, π, was fixed at 20.000 CFA. The actuarially fair price of the insurance was 10.000 CFA.

[8]We distributed fake money at the beginning of the third game.

[9]As mentioned above, the frame was randomly allocated across cooperatives (at a given farmer was presented only one frame).

	FrameA		FrameB	
	good yield	bad yield	good yield	bad yield
I	0	50.000	0	30.000
π	20.000	20.000	20.000	0

Table 3.4: premium and insurance indemnity

Second part: Eliciting WTP for the insurance In the second part of the third game we elicit the WTP for the insurance. Specifically players had to decide whether or not to buy the insurance contract used in the first part of the activity for various prices. The willingness to pay corresponds to the highest price farmers are willing to pay for the insurance. We decrease the price of the insurance contract from its base price of 30.000 CFA to 0 CFA, by decreases of 5.000 CFA (30.000-25.000-20.000-15.000-10.000-5000-0)[10]. The player must decide whether to buy the insurance and in latter case he had to choose the maximum price to pay for the insurance.

The visual representation of the game was exactly the same used for the other two games. In other words we used eight boxes, each one with two bags, a green one representing the not insurance and a blue one representing the insurance. In particular, in each pair farmers could see the insurance price, the savings[11] and the family money with and without the insurance. The first box was used as example and corresponded to a price of 50.000 CFA.

4 Analysis of experimental results

4.1 Results of game 1 and game 2: Eliciting Agents' Type

Table 4.1 reports the frequency of farmers switching at each of the possible eight pairs in the first two games. The first column of the table reports the switching points of the risky vs risky game (SwitchRR) and the second column the Switching points of the risky vs degenerate game (SwitchRD). Players are relatively evenly distributed over the range of switching points with a concentration of about 30% of the sample between points 3 and 4.

The majority of farmers present a coefficient of risk aversion between high and very high. Moreover, 10% and 13 % of the players of respectively game 1 and 2 appear risk lovers. this farmers never switched in the games and in Table4.1 they are identified with pair 9.

[10] In Appendix A1.3 we report the information available for the farmers in each pair

[11] Saving are family money less the insurance price

	SwitchRD			SwitchRR		
	Freq	pct	cumpct	Freq	pct	cumpct
2	65	11.27	11.27	84	14.56	14.56
3	78	13.52	24.78	76	13.17	27.73
4	90	15.60	40.38	97	16.81	44.54
5	84	14.56	54.94	90	15.60	60.14
6	61	10.57	65.51	56	9.71	69.84
7	59	10.23	75.74	44	7.63	77.47
8	64	11.09	86.83	65	11.27	88.73
9	76	13.17	100.00	65	11.27	100.00
Total	577	100.00		577	100.00	

Table 4.1: SwitchRD and SwitchRR

The Table 4.1 presents the cross tabulation of the switching points. In the vertiacl line we present the switching point of the risky vs risky game (SwitchRR) and in the horizontal line we present the switching point of the risky vs degenrate activity (SwitchRD) The expected utility agents are in the diagonal since they are switching at the same pair in both games. We then have two kinds of agents with discontinuous preferences. Agent with discontinuous preferences revealing strong preferences for certainty, we call these agents "andreoni" , and the ones having strong preferences for uncertainty, we call these agents "gamblers". Andreoni agents are in the part below the diagonal since they switched earlier in the second game than in the first one. The gamblers are in the area above the diagonal.

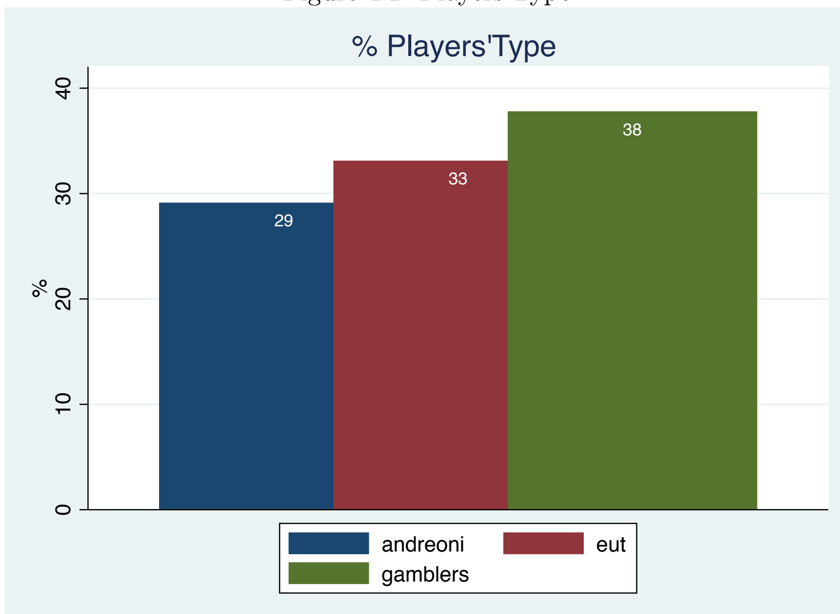
	(1)								
	2 Freq/Percent	3 Freq/Percent	4 Freq/Percent	5 Freq/Percent	6 Freq/Percent	7 Freq/Percent	8 Freq/Percent	9 Freq/Percent	Total Freq/Percent
2	33	14	9	3	2	6	8	9	84
	50.77	17.95	10.00	3.57	3.28	10.17	12.50	11.84	14.56
3	8	21	20	10	6	6	2	3	76
	12.31	26.92	22.22	11.90	9.84	10.17	3.12	3.95	13.17
4	8	19	29	18	9	6	5	3	97
	12.31	24.36	32.22	21.43	14.75	10.17	7.81	3.95	16.81
5	2	9	16	27	19	5	7	5	90
	3.08	11.54	17.78	32.14	31.15	8.47	10.94	6.58	15.60
6	1	8	4	7	13	11	7	5	56
	1.54	10.26	4.44	8.33	21.31	18.64	10.94	6.58	9.71
7	2	3	3	6	8	9	8	5	44
	3.08	3.85	3.33	7.14	13.11	15.25	12.50	6.58	7.63
8	5	2	6	9	3	13	20	7	65
	7.69	2.56	6.67	10.71	4.92	22.03	31.25	9.21	11.27
9	6	2	3	4	1	3	7	39	65
	9.23	2.56	3.33	4.76	1.64	5.08	10.94	51.32	11.27
Total	65	78	90	84	61	59	64	76	577
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Vertical SwitchingRR; Orizontal SwitchingRD

Table 4.2: crossing switching

The expected utility agents represent the 33% of the sample, andreoni agents are the 29% of the sample and gamblers are the 38%, as reported in the graph4.1

Figure 4.1: Players'Type



12

4.2 Results of the game 3: WTP by Agents' Type

In the willingness to pay game 10% of the people did not buy the insurance. Including people that did not buy the insurance as paying zero for the insurance, the average price that the full sample of farmers was willing to pay for the insurance was 15.771 FCFA, as reported in the first row and column of Table 4.3. This price was 5.771 FCFA above the actuarially fair price of the insurance set at 10.000 FCFA. The average willigness to pay for the the alternative insurance contract was 16.493 FCFA and for the traditional one was 15.051 FCFA, with a significative difference in the WTP of 1.442 FCFA. An interesting contrast emerges if we incorporate informations from game 1 and 2 to compare the WTP of the various "types" of farmers. Columns (2), (3) and (4) of Table 4.3distinguish between Andreoni, Gamblers and Expected Utility maximizers. While EUT and gamblers are not willing to pay significantly more for the insurance contract presented with uncertain premium, Andreoni agents are willing to pay 29% more when the contract was presented with this frame. In other words, the average difference in WTP seems driven by Andreoni agents, since the difference in WTP across the two insurance contracts is significantly different from zero only for Andreoni agents, as we can clearly see in the last

[12]We will explain the nature of the gamblers in the Appendix A2.1

row of the Table 4.3 where we report the p-values of the ttest of equality of means[13]

	Full(1)	Andreoni(2)	Gamblers(3)	EUT(4)
WTP	15.771	15.208	15.573	16.492
FrameA WTP	15.051 (10.328)	13.526 (10.540)	15.631(9.642)	15.989 (10.781)
FrameB WTP	16.493 (10.461)	17.397 (10.544)	15.521(9.673)	16.950 (11.256)
ttest (p-value)	0.09	0.01	0.9	0.5

Standard Deviation in Parenthesis

Table 4.3: Average WTP and ttest

4.2.1 Discontinuity of Preferences and Insurance Demand: Econometric Analysis

4.2.2 Discontinuity of Preferences and Insurance Demand: Econometric Analysis

In order to test whether the average difference in WTP across frames and agents' type holds, we control for individual characteristics and order effects. We use as dependent variable the individual willingness to pay for the insurance, $price_i$, and we control for the frame used to present the insurance, $frameA$, the agents' type (andreoni is the reference category), the interaction between the agent types and the frame, and a series of individual characteristics[14], X. We also control for order effects between the first and the second game. In particular, $game1_i$ is a dummy variable that takes value one if we started with the first game and value zero if we started with the second game.

We thus estimate the following tobit model:

$$price_i = \alpha_0 + \alpha_1 frameA_i + \alpha_2 eut_i + \alpha_3 frameA_i * eut_i + \alpha_4 gamblers_i + \\ + \alpha_5 frameA_i * gamblers_i + \alpha_6 game1_i + X\beta + \epsilon_i$$

where the dependent variable is censored by below at zero, since we do not observe the WTP for those agents not buying the insurance.

The Table 4.4 presents the estimated coefficients of the Tobit regressions. In the first column of Table 4.4we report the results without controlling for individual characteristics and in the second column we add individual characteristics as controls[15]. Table 4.5presents the marginal effects of frameA on the WTP for

[13]We perform the ttest on the equality of means. In particular we test whether the average willigness to pay for the insurance is the same within the two frames. We consider the full sample and each agent's type.

[14]The individual characteristics used in the regression are age, years of schooling, religion, ethnicity, household size, surface of land owned, years spent inside the cotton group

[15]In appendix A1.4 we reprot the tobit regression with all the individual charactristics in detail

the insurance separately for each agent type: andreoni, gamblers and expected utility agents. All standard errors are clustered at GPC level. We can see that agents with discontinuous preferences over certain and uncertain outcomes are willing to pay 4.326 FCFA less for an insurance presented with frameA than with frameB. This coefficient is significatively different from zero. Thus the *Hypothesis 1* is confirmed. Neither EUT agents nor Gamblers are willing to pay significatively more when the insurance is presented with frameA. Interesting the order of the games presented has a significative impact on the WTP. In particular we observe that starting from the risky vs risky game (game1) people are willing to pay more for the insurance.

	TOBIT	TOBITindiv
frameA	-4077.5*	-4918.5**
	(2076.9)	(2072.5)
eut	-292.0	-262.5
	(2247.2)	(2181.7)
frameAeut	2670.9	3077.7
	(2927.1)	(2859.8)
gamblers	-1344.0	-2031.9
	(1875.2)	(1844.2)
frameAgamblers	3991.8	5022.8*
	(2570.8)	(2663.2)
order_start_vertetbleu	3106.8***	3422.4***
	(1173.0)	(1249.4)
N	577	563

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.4: Tobit model

	TOBIT	TOBITindiv
frameA		
andreoni_at	-3577.0*	-4309.1**
	(1843.0)	(1840.0)
gamblers_at	-76.21	92.36
	(1254.3)	(1390.7)
eut_at	-1258.4	-1651.9
	(1859.0)	(1870.3)
N	577	563

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5: Marginal effects

5 Discussion

In this section we present thories that are relevant in the analysis of our result. These theories are prospect theory and separate mental accounting.

5.1 Alternative theories: Prospect Theory and Separate Mental Accounting

A primary alternatives to discontinuity of preference that may be relevant are prospect theory (Kahneman and Tversky 1979; Tversky and Khaneman, 1992) and separate mental accounting (Thaler, 1980;1999).

One of the main statements of prospect theory is that individuals evaluate gains and losses from a reference point using a value function. In our experiment the reference point can be represented both by the initial monetary endowment or the good yield.

In the following we allow for different reference points and we show that prospect theory alone can not explain our results. Only combining prospect theory and separate mental accounting we can have a partial explanations of our results.

Prospect Theory

We know that under prospect theory an agent will evaluate losses and gains with respect to a reference point.

We consider an agent with a reference point r and the following value function:

$$u(x) = \begin{cases} (x-r)^{\alpha} & if \quad x-r \geq 0 \\ -\lambda(-(x-r))^{\alpha} & if \quad x-r < 0 \end{cases}$$

We will consider as reference point both the initial wealth and the good yields. We will exclude that under prospect theory individuals prefer the alternative insurance frame to the traditional one. This is a consequence of the fact that, considering the initial wealth as reference point, individuals will never incur in a loss; and considering good yields as reference point the farmer will incur in a loss equal to the difference between the good and bad yield. But, in the game the indemnity will never cover the loss, therefore the value function of an individual under a traditional insurance contract will be identical to the alternative one.

CASE 1: Initial Wealth as Reference Point

Suppose that the reference point is the initial wealth of the agent, w. This is the classical reference point proposed by Syndor (2010) in evaluating a classical insurance contract.

In the case in which the individual will not buy the insurance, the utility function of the individual will only depend on the yields realization:

$$V_{NI} = p_b u(y_b) + (1 - p_b) u(y_g)$$

Suppose now that the individual buys a traditional insurance (frame A) paying a premium π in both states of the world.

If the good state occurs, the individual feels a loss only if the premium paid is bigger than the yield $\pi > y_g$. That is not the case with the amounts used in our experiment.

If the bad state occurs, the individual receives an indemnity I. In this case, the individual will fell a loss if the premium paid is higher than the indemnity plus the bad yield .That is not the case.

Therefore the value function under contract A results as follows:

$$V_{I,A} = p_b u(y_b + I - \pi) + (1 - p_b) u(y_g - \pi)$$

where

p_b =probability to have a bad yield

y_b =bad yield

y_g =good yield

I= indemnity

π= premium

Considering the functional form of $u(.)$, we can rewrite the value function as follows:

$$V_{I,A} = p_b (y_b + I - \pi)^\alpha + (1 - p_b)(y_g - \pi)^\alpha$$

Suppose now that the individual bought an alternative insurance (frame B) paying a premium, π , only if the good state of the world occurs.

If the good state occurs, the individual feels a loss only if the premium paid is bigger than the yield $\pi > y_g$. That is not the case.

If the bad state occurs, the individual receives an indemnity I'. In this case, the individual will never fell a loss since he does not pay the premium

Therefore the value function under contract B results as follows:

$$V_{I,B} = p_b u(y_b + I') + (1 - p_b) u(y_g - \pi)$$

with $I' = I - \pi$

that is

$$V_{I,B} = p_b(y_b + I')^\alpha + (1 - p_b)(y_g - \pi)^\alpha$$

We can see that in this case the value functions under the two insurance contracts are the same.

CASE2: Good Yield as Reference Point

Suppose now that the reference point of the agent is the good yield, y_g. In case of bad yields the farmer will perceive a loss equal to the difference between the bad and the good yields, $L = y_b - y_g < 0$.

In the case in which the individual will not buy the insurance, he will incur in a loss L in the bad state of the world and in a gain of zero in good state of the world:

$$V_{NI} = p_b u(-L) + (1 - p_b)u(0)$$

Suppose now that the individual buys a traditional insurance (frame A) paying a premium π in both states of the world.

If the good state occurs, the individual feels a loss equal to the premium since the insurance did not "payoff".

If the bad state occurs, the loss occurs and the individual receives an indemnity I. In this case, we can have that:

- the premium paid is higher than the indemnity minus the loss, therefore the individual will still feel that the insurance did not pay off. Therefore he will fell a loss equal to:$\pi + L - I$

-the premium paid is lower than the indemnity minus the loss , therefore the individual will feel a gain equal to: $I - \pi - L$

We are in the situation in which the individual feels a loss since the indemnity will never cover the loss .Therefore the value function of an individual under a traditional insurance contract will be as follows:

that is

$$V_{I,A} = -\lambda p_b(\pi + L - I)^\alpha - \lambda(1 - p_b)(\pi)^\alpha$$

Suppose now that the individual buys an alternative insurance (frame B) paying a premium, π , only if the good state of the world occurs.

If the good state occurs, the individual feels a loss equal to the premium since the insurance did not "payoff".

If the bad state occurs, the loss occurs and the individual receives an indemnity I', but the indemnity received from the insurance will never cover the loss, therefore the agent will fell a loss equal to $L - I'$. Therefore the utility under alternative insurance contract will be as follows:

$$V_{I,B} = p_b u(I' - L) + (1 - p_b)u(-\pi)$$

that is

$$V_{I,B} = -\lambda p_b(-I' + L)^\alpha - \lambda(1 - p_b)(\pi)^\alpha$$

It results that the value function of an individual under a traditional insurance contract and an alternative one will be identical, since the indemnity will never cover the losses in both frames:

$$-\lambda p_b(-I' + L)^\alpha - \lambda(1 - p_b)(\pi)^\alpha = -\lambda p_b(\pi + L - I)^\alpha - \lambda(1 - p_b)(\pi)^\alpha$$

If we combine prospect theory with separate mental accounting we can find values of risk and loss aversion such that people prefer the alternative frame to the traditional one.

Separate mental accounting

In the separate mental accounting theory (Thaler, 1980; 1999) people use the value function proposed by Khaneman and Tversky(1979). In general there are three kinds of separate mental accounting, but the interesting one is the topical mental accounting:

- minimal account: it entails examining only the differences between the two options, disregarding all their common features.
- topical account: it relates the consequences of possible choices to a reference level that is determined by the context within which the decision arises.
- comprehensive account: it incorporates all other factors including current wealth, future earnings, possible outcomes of other probabilistic holdings, and so on.

Classical Economic theory consider that people use a comprensive account .

In order to understand how the mental accounting is working we report the experiment proposed by Khaneman and Tversky(1985), that i s a slightly modification of the experiment of Thaler (1980). Imagine the following situation:

- Situation A: You are about to purchase a jacket for \$125 and a calculator for \$15. The salesman mentions that the calculator is on sale for \$10 at another branch of the store 20 minutes away by car. Would you make the trip?
- Situation B: You are about to purchase a calculator for \$125 and a jacket for \$15. The salesman mentions that the calculator is on sale for \$120 at another branch of the store 20 minutes away by car. Would you make the trip?

Since 68% (N=88) of subjects were willing to drive to the other store in A, but only 29% (N=93) in B, the mental accounting coming from the experiment is the topical mental accounting. In particular, in the minimal mental accounting subjects would ask themselves, " do i want to drive 20 m to save 5 dollars? In this case the answers will be the same in both situations. In the comprensive accounting subjects compare $W^* + 5\$$ to $W^* + 20m$, where $W^* = W + JACKET + CALCULATOR - 140\$$. In this case the answers will be the same in both situations. Only in the topical mental accounting the answers at the two situations presented would have been different. In particular, under the topical accounting (hedonic framing), five dollars seems like a significant saving on a \$15 purchase, but not so on a \$125 purchase. In other words, reducing the price of the calculator from \$15 to \$10 is perceived more salient discount than reducing the price of the calculator from \$125 to \$120. But this disparity implies that the utility of the saving must be associated with the differences in values rather than the value of the difference , otherwise the two prospects must be the same $v(-125) - v(-120) < v(-15) - v(-10)$ rather that $v(5)$ otherwise the two prospects will be the same.

Let' s now go back to our insurance context.

Suppose that people separate the initial endowment and the premium paid from the yield and the indemnity received.

The utilities under the traditional and the alternative insurance contracts will result as follows

$$V_{I,A} = p_b u(w - \pi) + p_b u(y_b + I) + (1 - p_b)u(w - \pi) + (1 - p_b)u(y_g)$$

$$V_{I,B} = p_b u(w) + p_b u(y_b + I') + (1 - p_b)u(w - \pi) + (1 - p_b)u(y_g)$$

Substituting the numerical values used in the experiment, for an insurance price of 2000 CFA, we can see that people always prefer the alternative contract (frameB) to the traditional one (frameA), since $V_{I,B} > V_{I,A}$ $\forall$ $0 < \alpha < 1$:

$$u(w) - u(w - \pi) > u(y_b + I) - u(y_b + I')$$

It follows that our results can be explained by separate mental accounting and its segregation of the utilities functions.

6 Conclusions

In recent years the demand of index insurances has been characterized by a surprisingly low take up, although index insurances provides a good alternative to the informal risk managing mechanism.

In this paper we have attempted to demonstrate how an understanding of behavioral economics could help in designing supply insurance policies in respect to the farmers behavior. In this paper, we presented a novel way to understand these low uptake rates, using the concept of discontinuity of preferences. In a framed field experiments conducted with cotton farmers in Burkina Faso, we elicited the coefficients of risk-aversion and the WTP for the insurance. We found that 29% of the farmers generally did not behave in accordance with expected utility theory, and show discontinuous preferences as observed by Andreoni and Sprenger(2009). Moreover the farmers that revealed themselves to have discontinuous preferences are the ones willing to pay more for an insurance contract with uncertain premium.

References

[1] Andreoni, James, and Charles Sprenger.2012. "Risk Preferences are not time preferences."*American Economic Review* 102(7): 3357-76.

[2] Andreoni James and Charles Sprenger. 2009. "Certain and Uncertain Utility: The Allais Paradox and Five Decision Theory Phenomena."

[3] Carter, Michael R., Lan Cheng, and Alexander Sarris. 2011., "The impact of interlinked index insurance and credit contracts on financial market deepening and small farm productivity." Mimeo

[4] Cole, Shawn, Gine, Xavier, Tobacman, Jeremy, Topolova, Petia,Townsend, Robert and Vickery James. 2013. " Barriers to Household Risk Management: Evidence from India". *American Economic Journal: Applied Economics* 5(1):104-135.

[5] Elabed Ghada, and Michael R. Carter. 2014. "Basis risk and Compound-Risk Aversion: Evidence from a WTP experiment in Mali."

[6] Gine, Xavier, and Dean Yang. 2007. "Insurance, Credit and Technology Adoption: Field Experiment Evidence from Malawi." *Journal of Development Economics* 89 (2009): 1–11

[7] Gine, Xavier, Robert Townsend and JamesVickery .2008. "Patterns of Rainfall Insurance Participation in Rural India." *The World Bank Economic Review* 22(3): 539–566

[8] Gneezy, Uri, John A. List and George Wu. 2006. "The Uncertainty effect: When a Risky Prospect Is Valuated Less Than Its Worst Possible Outcome." *Quartley Journal of Economics* 121(4): 1283-309.

[9] Holt Charles A., Laury Susan K.2002." Risk Aversion and Incentive Effects." *American Economic Review* 92(5): 1644-1655

[10] Khaneman, Daniel, and Amos Tversky. 1979. "Prospect Theory: An Analysis of Decision under risk." *Econometrica* 47(2): 263-91.

[11] Khaneman, Daniel, and Amos Tversky. 1984. "Choices, Values and Frames." The American Psycologist 39: 341-350.

[12] Shmit, Ulrich .1998.,"A Measurement of the Certainty Effect." *Journal of Mathematical Psychology* 42:32-47

[13] Sydnor, Justin. 2010. "(Over) Insuring Modest Risks." *American Economic Journal: Applied Economics*, 2(4), 177-99.

[14] Thaler, Richard H. and M. Shefrin.1981. "An Economic Theory of Self Control." *Jouranl of Political Economy* 89: 392-406.

[15] Thaler, Richard H.. "Mental Acoounting matters." *Jouranl of Behavioral Decision Making* 12: 183-206.

Appendix

A1: Tables

A1.1: Randomization

The table6.1 presents the results of the randomization.In particular, we have 145 players starting with risky vs degenerate activity (second game) and at whom was proposed the insurance frame with uncertain premium (frame B) ;143 players starting with risky vs risky activity (first game) and at whom was proposed the insurance frame with uncertain premium (frame B);138 players starting with risky vs degenerate activity (second game) at whom was proposed the traditional insurance frame (frameA) ;151 players starting with risky vs risky activity (first game) at whom was proposed the traditional insurance frame (frameA)

	(1)		
	a_RD vs a_RR	a_RR vs a_RD	Total
FrameB	145	143	288
FrameA	138	151	289
Total	283	294	577

Table 6.1: Randomization

A1.2: Individual characteristics and balanced randomization

The table 6.2 reports detailed individual characteristics. The values reported for each individual characteristic are the Mean, the Standard Deviation and the Number of Observations. The variables considered are the age of the household head (cmage), the years since the farmer is at the head of the household (yearsHH), the years of education, the religion (1. Animist 2. Christian 3. Muslim), the ethnie (1.Bwaba 2.Mossi 3.Other), the household size[16] (hsize),

[16]We consider the member alive and living inside the family

the number of children in the family[17] (nchildren), the surface of land owned in 2013 (surfaceowned 2013) and the surface cultivated with cotton in 2013 (supcotton2013), whether the agent worked in the mines at least one time in the life (mineonceworked), the time that has passed since he last worked in the mines (yearslasttimemine), The amount of credit taken for agricultural activity in 2013 (credit2013ha), and whether the agent is a leader of the cotton group[18]

	(1)		
	mean	sd	count
cmage	44.12	12.79	577
yearschooling	0.96	2.15	565
education	0.22	0.41	565
Musulman	0.41	0.49	577
Animiste	0.34	0.47	577
Christian	0.25	0.44	577
Bwaba	0.38	0.49	577
Mossi	0.38	0.49	577
Other	0.24	0.42	577
hsize	8.69	5.26	576
nchildr	4.31	3.26	576
yearsinGPC	10.35	6.23	575
yearsHH	15.89	11.65	576
surfaceowned2013	10.12	7.06	577
supcotton2013	3.85	3.26	572
credit2013ha	47125.89	111051.60	571
leader	0.08	0.27	577

Table 6.2: Individual characteristics

In the Table 6 we report the individual characteristics distinguishing for the frame (frameA and frameB) and the agent's type. The values reported for each individual characteristic are the Mean, the Standard Deviation (in parenthesis) and the Number of observations.

[17]We consider the children alive and with an age lower than 19

[18]Leader takes value 1 if the agent is President or Secretaire of the GPC

	(1)	(2)	(3)	(4)	(5)	(6)
	AndreoniA	AndreoniB	EutA	EutB	GamblersA	GamblersB
	mean/sd/N	mean/sd/N	mean/sd/N	mean/sd/N	mean/sd/N	mean/sd/N
cmage	43.04	44.48	45.19	47.01	42.98	42.46
	(12.51)	(12.62)	(12.55)	(14.08)	(12.06)	(12.54)
	95.00	73.00	91.00	100.00	103.00	115.00
yearschooling	0.95	0.53	1.21	0.91	0.79	1.24
	(2.25)	(1.59)	(2.33)	(1.97)	(1.90)	(2.54)
	93.00	70.00	89.00	97.00	103.00	113.00
education	0.18	0.16	0.26	0.23	0.20	0.26
	(0.39)	(0.37)	(0.44)	(0.42)	(0.40)	(0.44)
	93.00	70.00	89.00	97.00	103.00	113.00
Musulman	0.54	0.34	0.42	0.35	0.44	0.36
	(0.50)	(0.48)	(0.50)	(0.48)	(0.50)	(0.48)
	95.00	73.00	91.00	100.00	103.00	115.00
Animiste	0.26	0.29	0.37	0.38	0.30	0.41
	(0.44)	(0.46)	(0.49)	(0.49)	(0.46)	(0.49)
	95.00	73.00	91.00	100.00	103.00	115.00
Christian	0.20	0.37	0.21	0.27	0.26	0.23
	(0.40)	(0.49)	(0.41)	(0.45)	(0.44)	(0.43)
	95.00	73.00	91.00	100.00	103.00	115.00
Bwaba	0.31	0.36	0.48	0.30	0.44	0.42
	(0.46)	(0.48)	(0.50)	(0.46)	(0.50)	(0.50)
	95.00	73.00	91.00	100.00	103.00	115.00
Mossi	0.48	0.38	0.32	0.37	0.34	0.38
	(0.50)	(0.49)	(0.47)	(0.49)	(0.48)	(0.49)
	95.00	73.00	91.00	100.00	103.00	115.00
Other	0.21	0.26	0.20	0.33	0.22	0.20
	(0.41)	(0.44)	(0.40)	(0.47)	(0.42)	(0.40)
	95.00	73.00	91.00	100.00	103.00	115.00
hsize	9.29	8.26	8.76	8.97	8.22	8.58
	(5.83)	(4.80)	(5.98)	(5.08)	(4.51)	(5.24)
	95.00	72.00	91.00	100.00	103.00	115.00
nchildr	4.51	4.25	4.40	4.39	3.99	4.31
	(3.86)	(2.61)	(3.81)	(2.97)	(2.77)	(3.31)
	95.00	72.00	91.00	100.00	103.00	115.00
yearsinGPC	9.95	10.51	10.49	11.03	9.87	10.30
	(6.17)	(6.25)	(5.85)	(6.75)	(6.09)	(6.27)
	95.00	73.00	91.00	100.00	101.00	115.00
yearsHH	14.29	17.18	15.10	17.08	17.04	14.97
	(11.23)	(12.82)	(10.89)	(12.46)	(11.06)	(11.53)
	95.00	73.00	91.00	100.00	102.00	115.00
surfaceowned2013	9.92	10.58	9.74	9.85	9.65	10.96
	(6.95)	(7.04)	(6.70)	(6.75)	(7.08)	(7.73)
	95.00	73.00	91.00	100.00	103.00	115.00
supcotton2013	3.88	3.70	3.95	3.66	3.61	4.23
	(3.56)	(3.51)	(2.92)	(2.97)	(2.92)	(3.62)
	95.00	71.00	89.00	99.00	103.00	115.00
credit2013ha	41993.46	39361.44	55768.37	61302.35	39443.70	44121.26
	(31697.46)	(22410.89)	(87163.76)	(248371.94)	(18689.74)	(31167.29)
	95.00	71.00	89.00	99.00	103.00	114.00
leader	0.08	0.10	0.05	0.07	0.08	0.10
	(0.28)	(0.30)	(0.23)	(0.26)	(0.27)	(0.31)
	95.00	73.00	91.00	100.00	103.00	115.00

Table 6.3: Individual Characteristics by Frame and Agents'type

In the Table6 we add a column to the previous table reporting the p-values of the ttest. In particular, we test for each agent's type whether there is a significative difference in the individual characteristics of agents at whom was presented the frameA and the ones at whom was presented the frameB . We can see that the randomization of the frames is balanced.

	(1) AndreoniA	(2) AndreoniB	(3) ttestandr	(4) EutA	(5) EutB	(6) ttesteut	(7) GamblersA	(8) GamblersB	(9) ttestgamblers
cmage	43.04	44.48		45.19	47.01		42.98	42.46	
	(12.51)	(12.62)		(12.55)	(14.08)		(12.06)	(12.54)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.46			0.35			0.76
yearschooling	0.95	0.53		1.21	0.91		0.79	1.24	
	(2.25)	(1.59)		(2.33)	(1.97)		(1.90)	(2.54)	
	93.00	70.00	163.00	89.00	97.00	186.00	103.00	113.00	216.00
			0.19			0.33			0.14
education	0.18	0.16		0.26	0.23		0.20	0.26	
	(0.39)	(0.37)		(0.44)	(0.42)		(0.40)	(0.44)	
	93.00	70.00	163.00	89.00	97.00	186.00	103.00	113.00	216.00
			0.67			0.62			0.36
Musulman	0.54	0.34		0.42	0.35		0.44	0.36	
	(0.50)	(0.48)		(0.50)	(0.48)		(0.50)	(0.48)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.01			0.34			0.23
Animiste	0.26	0.29		0.37	0.38		0.30	0.41	
	(0.44)	(0.46)		(0.49)	(0.49)		(0.46)	(0.49)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.73			0.93			0.10
Christian	0.20	0.37		0.21	0.27		0.26	0.23	
	(0.40)	(0.49)		(0.41)	(0.45)		(0.44)	(0.43)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.01			0.33			0.64
Bwaba	0.31	0.36		0.48	0.30		0.44	0.42	
	(0.46)	(0.48)		(0.50)	(0.46)		(0.50)	(0.50)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.49			0.01			0.77
Mossi	0.48	0.38		0.32	0.37		0.34	0.38	
	(0.50)	(0.49)		(0.47)	(0.49)		(0.48)	(0.49)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.19			0.46			0.51
Other	0.21	0.26		0.20	0.33		0.22	0.20	
	(0.41)	(0.44)		(0.40)	(0.47)		(0.42)	(0.40)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.45			0.04			0.68
hsize	9.29	8.26		8.76	8.97		8.22	8.58	
	(5.83)	(4.80)		(5.98)	(5.08)		(4.51)	(5.24)	
	95.00	72.00	167.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.22			0.79			0.59
nchildr	4.51	4.25		4.40	4.39		3.99	4.31	
	(3.86)	(2.61)		(3.81)	(2.97)		(2.77)	(3.31)	
	95.00	72.00	167.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.63			0.99			0.44
yearsinGPC	9.95	10.51		10.49	11.03		9.87	10.30	
	(6.17)	(6.25)		(5.85)	(6.75)		(6.09)	(6.27)	
	95.00	73.00	168.00	91.00	100.00	191.00	101.00	115.00	216.00
			0.56			0.56			0.61
yearsHH	14.29	17.18		15.10	17.08		17.04	14.97	
	(11.23)	(12.82)		(10.89)	(12.46)		(11.06)	(11.53)	
	95.00	73.00	168.00	91.00	100.00	191.00	102.00	115.00	217.00
			0.12			0.25			0.18
surfaceowned2013	9.92	10.58		9.74	9.85		9.65	10.96	
	(6.95)	(7.04)		(6.70)	(6.75)		(7.08)	(7.73)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.54			0.91			0.20
supcotton2013	3.88	3.70		3.95	3.66		3.61	4.23	
	(3.56)	(3.51)		(2.92)	(2.97)		(2.92)	(3.62)	
	95.00	71.00	166.00	89.00	99.00	188.00	103.00	115.00	218.00
			0.74			0.49			0.17
credit2013ha	41993.46	39361.44		55768.37	61302.35		39443.70	44121.26	
	(31697.46)	(22410.89)		(87163.76)	(248371.94)		(18689.74)	(31167.29)	
	95.00	71.00	166.00	89.00	99.00	188.00	103.00	114.00	217.00
			0.55			0.84			0.19
leader	0.08	0.10		0.05	0.07		0.08	0.10	
	(0.28)	(0.30)		(0.23)	(0.26)		(0.27)	(0.31)	
	95.00	73.00	168.00	91.00	100.00	191.00	103.00	115.00	218.00
			0.79			0.67			0.50

p-value reported for the ttest

Table 6.4: Individual Characteristics by Frame and Agents'type

A1.3: WTP game

		NI			A		B		
		bad yield	good yield	EV	bad yield	good yield	bad yield	good yield	EV
pair 1	savings	50.000	50.000		0	0	50.000	0	
	family money	**238.000**	**94.000**	209.200	**94.000**	**188.000**	**94.000**	**188.000**	169.200
pair 2	savings	50.000	50.000		20.000	20.000	50.000	20.000	
	family money	**238.000**	**94.000**	209.200	**114.000**	**208.000**	**114.000**	**208.000**	189.200
pair 3	savings	50.000	50.000		25.000	25.000	50.000	25.000	
	family money	**238.000**	**94.000**	209.200	**119.000**	**213.000**	**119.000**	**213.000**	194.200
pair 4	savings	50.000	50.000		30.000	30.000	50.000	30.000	
	family money	**238.000**	**94.000**	209.200	**124.000**	**218.000**	**124.000**	**218.000**	199.200
pair 5	savings	50.000	50.000		35.000	35.000	50.000	35.000	
	family money	**238.000**	**94.000**	209.200	**129.000**	**223.000**	**129.000**	**223.000**	204.200
pair 6	savings	50.000	50.000		40.000	40.000	50.000	40.000	
	family money	**238.000**	**94.000**	209.200	**134.000**	**228.000**	**134.000**	**228.000**	209.200
pair 7	savings	50.000	50.000		45.000	45.000	50.000	45.000	
	family money	**238.000**	**94.000**	209.200	**139.000**	**233.000**	**139.000**	**233.000**	214.200
pair 8	savings	50.000	50.000		50.000	50.000	50.000	50.000	
	family money	**238.000**	**94.000**	209.200	**144.000**	**238.000**	**144.000**	**238.000**	219.200

Table 6.5: WTP game

A1.4: Tobit regression controlling for individual characteristics

	TOBITindiv
frameA	-4918.5**
	(2072.5)
eut	-262.5
	(2181.7)
frameAeut	3077.7
	(2859.8)
gamblers	-2031.9
	(1844.2)
frameAgamblers	5022.8*
	(2663.2)
cmage	-21.04
	(69.85)
Mossi	650.4
	(2005.6)
Other	-783.6
	(1490.1)
Christains	835.9
	(1402.5)
Muslims	2193.0
	(1866.3)
yearschooling	323.1
	(287.3)
yearsHH	-43.30
	(62.30)
hsize	-156.9
	(127.8)
surfaceowned2013	207.7**
	(90.40)
order_start_vertetbleu	3422.4***
	(1249.4)
_cons	14319.1***
	(3175.7)
sigma	
_cons	11961.7***
	(462.0)
N	563

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.6: Tobit controlling fro individual characteristics

A2.1: The Nature of the Gamblers

In the Table 6 we report detailed individual characteristics distinguishing for the three agent types: gamblers, andreoni and expected utility agents. The values reported for each individual characteristic are the Mean, the Standard Deviation and the Number of Observations. The variables considered are the age of the household head (cmage), the yearssince the farmer is at the head of the household (yearsHH), the years of education, the religion (1. Animist 2. Christian 3. Muslim), the ethnie (1.Bwaba 2.Mossi 3.Other), the household size[19] (hsize), the number of children in the family[20] (nchildren), the surface of land owned in 2013 (surfaceowned 2013) and the surface cultivated with cotton in 2013 (supcotton2013), the amount of credit taken for agricultural activity in 2013 (credit2013ha), and whether the agent is a leader of the cotton group[21]

[19]We consider the member alive and living inside the family

[20]We consider the children alive and with an age lower than 19

[21]Leader takes value 1 if the agent is President or Secretaire of the GPC

	(1) gamblers mean/sd/N	(2) eut mean/sd/N	(3) andreoni mean/sd/N
cmage	42.71	46.14	43.67
	(12.29)	(13.37)	(12.54)
	218	191	168
yearschooling	1.02	1.05	0.77
	(2.26)	(2.15)	(2.00)
	216	186	163
Musulman	0.39	0.38	0.45
	(0.49)	(0.49)	(0.50)
	218	191	168
Animiste	0.36	0.38	0.27
	(0.48)	(0.49)	(0.45)
	218	191	168
Christian	0.25	0.24	0.27
	(0.43)	(0.43)	(0.45)
	218	191	168
Bwaba	0.43	0.39	0.33
	(0.50)	(0.49)	(0.47)
	218	191	168
Mossi	0.36	0.35	0.44
	(0.48)	(0.48)	(0.50)
	218	191	168
Other	0.21	0.27	0.23
	(0.41)	(0.44)	(0.42)
	218	191	168
hsize	8.41	8.87	8.85
	(4.91)	(5.51)	(5.42)
	218	191	167
nchildr	4.16	4.39	4.40
	(3.07)	(3.39)	(3.37)
	218	191	167
yearsinGPC	10.10	10.77	10.19
	(6.17)	(6.32)	(6.19)
	216	191	168
yearsHH	15.94	16.14	15.55
	(11.33)	(11.75)	(11.99)
	217	191	168
surfaceowned2013	10.34	9.80	10.21
	(7.44)	(6.71)	(6.98)
	218	191	168
supcotton2013	3.94	3.80	3.80
	(3.32)	(2.95)	(3.53)
	218	188	166
credit2013ha	41901.04	58682.54	40867.72
	(26050.29)	(189504.03)	(28056.59)
	217	188	166
leader	0.09	0.06	0.09
	(0.29)	(0.24)	(0.29)
	218	191	168

Table 6.7: indiv characteristics by agent type

We run a multinomial probit to check for the individual characteristics affecting the probability to be of a determinate agent type. We cluster at GPC level.

In the Table 6 we report the results of the mprobit estimation. The reference category is represented by the eut agent. The other two categories are andreoni and gamblers. We can see that the individual characteristics with a significant effect are the age of the household head “cmage” and the years since the farmer is at the head of the family, “yearsHH”. In particular, we can see that a one unit increase in “cmage” induces a decrease in the probability of being andreoni wrt the probability to be an eut. Moreover a one unit increase in cmage induces a decrease in the probability of being gamblers wrt the probability to be eut. Concerning the yearsHH the effect is more clear if we look at the marginal effect. In the Table **??** we report the coefficients of the marginal effect. It is clear that the age and the yearsHH do not significatively affect the probability to be andreoni, but they have a significative and opposite effect on the probability to be an expected utility maximizer and a gambler. In other words, for the gamblers there is positive effect of the yearsHH on the probability to be a gambler. For the expected utility agents there is a negative effect of the yearsHH on the probability to be an eut agent. It seems therefore that agents with more years at the head of the household are more likely to be gamblers and less likely to be expected utility maximizers. Moreover the age has a significative and negative effect on the probability to be gamblers and a significative and positive effect on the probability to be eut agent.

How can we explain this opposite effect?

May be the years since the individual is at the head of the household can be a proxy for the moment in which the farmer became an independent farmers. Therefore gamblers can be people that took their independence earlier than the others.

	mprobit
andreoni	
cmage	-0.0259***
	(0.00911)
yearschooling	-0.0602
	(0.0476)
hsize	-0.0372
	(0.0374)
surfaceowned2013	0.0203
	(0.0252)
supcotton2013	-0.00294
	(0.0564)
2.religion	0.257
	(0.226)
3.religion	0.137
	(0.314)
2.ethnie	0.416
	(0.358)
3.ethnie	0.00723
	(0.284)
yearsinGPC	-0.00300
	(0.0162)
yearsHH	0.0177
	(0.0110)
mineonceworked	0.154
	(0.221)
nchildr	0.0438
	(0.0491)
credit2013ha	-0.000000896
	(0.00000211)
leader	0.361
	(0.337)
_cons	0.494
	(0.440)
gamblers	
cmage	-0.0373***
	(0.00997)
yearschooling	-0.0286
	(0.0445)
hsize	-0.0522
	(0.0354)
surfaceowned2013	0.0131
	(0.0214)
supcotton2013	0.0108
	(0.0420)
2.religion	0.00869
	(0.247)
3.religion	0.00515
	(0.289)
2.ethnie	0.264
	(0.304)
3.ethnie	-0.194
	(0.231)
yearsinGPC	-0.00553
	(0.0154)
yearsHH	0.0287**
	(0.0114)
mineonceworked	-0.0575
	(0.252)
nchildr	0.0487
	(0.0508)
credit2013ha	-0.00000125
	(0.00000191)
leader	0.311
	(0.360)
_cons	1.455***
	(0.422)
N	555

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.8: prob to be agent type

	gamblers	eut	andreoni
cmage	-0.00679***	0.00876***	-0.00197
	(0.00228)	(0.00212)	(0.00195)
yearsHH	0.00588**	-0.00635**	0.000475
	(0.00276)	(0.00260)	(0.00238)
N	555	555	555

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.9: marginal effects

The two variables are NOT correlated

In the following table I recode the variable yearsHH in four age groups (yearsHH<= 6; 6<yearsHH<=12;12<yearsHH<=22; 22<yearsHH<=52) .The reference category is yearsHH<=6. There exists the same effects observed before.In particular we can see that there is a monotonically increasing effect of the years spent ath the head of the family on the probability to be a gambler, and a monotonically decreasing effect of the years spent at the head of the family on the probability to be expected utility maximizer.

	(1)	
	yearsHHcat	
	freq	pct
6	144	25.00
12	138	23.96
22	151	26.22
52	143	24.83
Total	576	100.00
N	576	

Table 6.10: years spent in GPC

	gamblers	eut	andreoni
cmage	-0.00699***	0.00797***	-0.000980
	(0.00207)	(0.00192)	(0.00168)
6b.yearsHHcat	0	0	0
	(.)	(.)	(.)
12.yearsHHcat	0.0725	-0.0120	-0.0605
	(0.0538)	(0.0603)	(0.0548)
22.yearsHHcat	0.125**	-0.0737	-0.0510
	(0.0600)	(0.0598)	(0.0510)
52.yearsHHcat	0.207***	-0.153**	-0.0536
	(0.0757)	(0.0684)	(0.0632)
N	557	557	557

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.11: marginal effects

A3.1: Instruction for the insurance game

Insurance presented with TRADITIONAL FRAME (FrameA) "An insurance on cotton production is something you buy before you know your yield. The insurance gives you some money after the harvest, but only in case of bad yield. Let me explain how the insurance works.

The amount of your savings is 50.000 CFA. You decide to buy an insurance before you know your yield. The insurance price is 20.00 CFA.You pay the insurance with your savings. Therefore you remain with 30.000 CFA

- In case of a bad yield [indicate pink ball in the poster]

  You payed the insurance, your savings left are 30.000 CFA [indicate amount in the poster].The cotton revenue [indicate image in the poster] is 44.000 CFA [indicate amount in the poster]. The insurance [indicate image in the poster]gives you 50.000 CFA [indicate amount in the poster] since you had a bad yield.

How much family money [indicate image in the poster] do you have with the insurance in case of bad yield [indicate pink ball in the poster] ?

The family money is composed by:

- 30.000 CFA [indicate amount] that are the savings left after the insurance payment, plus

- 44.000 [indicate] that is the cotton revenue, plus

- 50.000 [indicate] CFA that the insurance gives you since you had a bad yield

Therefore the family money [indicate image] is 124.000 CFA [indicate amount]

- In case of a good yield [indicate orange balls in the poster]

You payed the insurance, your savings left are 30.000 CFA [indicate amount in the poster].The cotton revenue [indicate image in the poster] is 188.000 CFA [indicate amount in the poster]. The insurance [indicate image in the poster] gives you 0 CFA [indicate amount in the poster] since you had a good yield,.

How much family money [indicate image in the poster] do you have with the insurance in case of good yield [indicate orange ball in the poster]?

The family money is composed by:

- 30.000 CFA [indicate amount], that are the savings left after the insurance payment, plus

-188.000 CFA [indicate] that is the cotton revenue, plus

- 0 CFA since the insurance does not give you anything in case of good yield

Therefore the family money [indicate image] is 218.000 CFA [indicate amount]

Insurance presented with ALTERNATIVE FRAME (FrameB)

"An insurance on cotton production is something you buy before you know your yield. The insurance gives you some money after the harvest, but only in case of bad yield.Let me explain how the insurance works.

The amount of your savings is 50.000 CFA . You decide to buy an insurance before you know your yield. The insurance price is 20.000 CFA.You pay the insurance with your savings, BUT only in case of good yield. Therefore you remain with 30.000 CFA in case of good yield and 50.000 CFA in case of bad yield.

- In case of a bad yield [indicate pink ball in the poster]

You do NOT pay the insurance, your savings remain 50.000 CFA [indicate amount in the poster.]The cotton revenue [indicate image in the poster] is 44.000 CFA [indicate amount in the poster]. The insurance [indicate image in the poster] gives you 30.000 CFA [indicate amount in the poster] since you had a bad yield.

How much family money [indicate image in the poster] do you have with the insurance in case of bad yield [indicate pink ball in the poster] ?

The family money is composed by:

- 50.000 CFA [indicate amount], that are all your savings plus

- 44.000 CFA [indicate], that is the cotton revenue plus

- 30.000 [indicate] CFA that the insurance is giving you since you had a bad yield

Therefore the family money [indicate image] is 124.000 CFA [indicate amount]

- in case of a good yield [indicate orange balls in the poster]

You pay the insurance, your savings left are 30.000 CFA [indicate amount in the poster].The cotton revenue [indicate image in the poster] is 188.000 CFA [indicate amount in the poster].The insurance [indicate image in the poster]gives you 0 CFA [indicate amount in the poster] since you had a good yield .

How much family money [indicate image in the poster] do you have with the insurance in case of good yield [indicate orange ball in the poster]?

The family money is composed by:

- 30.000 CFA [indicate amount], that are the savings left after the insurance payment, plus

-188.000 CFA [indicate] that is the cotton revenue, plus

- 0 CFA since the insurance does not give you anything in case of good yield

Therefore the family money [indicate image] is 218.000 CFA [indicate amount]