Eliciting Preferences Over Risk: An Experiment

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Eliciting Preferences Over Risk: An Experiment

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Abstract

Previous research has begun to investigate how small groups make decisions when facing risky choices. However, no consensus has been reached. One stream of research found that groups are more risk averse, while another one reported the contrary and some studies did not even find any significant difference. This paper is meant to provide a clear comparison between two different experimental designs from Harrison et al. (2012) and Zhang and Casari, (2012). The former tests the risk preferences of groups of three members where group's decision is taken with the majority rule; the latter, also tests risk preferences of three-members group, but using a different lottery set and aggregation rule, i.e. unanimity. These two experiments lead to different results: Harrison et al. (2012) did not find any substantial difference between individuals' and groups' preferences over risk, while Zhang and Casari (2012) found that groups tend to be more prone to the risk neutrality than individuals. Additionally, we present a replication study of Harrison et al. (2012) and Zhang and Casari (2012) in order to check to what extent the lottery set and the aggregation rule (majority or unanimity) adopted to elicit preferences may affect the final group choice. It results that individual and group choices are not significantly different, regardless of the lottery set and the aggregation rule used in the experimental design.

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1. Introduction

What have in common a company managed by a board of directors, an important purchase planned by the whole family and political parties' deliberations? They are all decisions taken by groups. Indeed, in the real life groups, rather than individuals, make most choices. However, for a long time economists have been studying only individual decision-making. Nevertheless, in-group interaction may have an impact on the final outcome. Is the final result just a sum of individual preferences or group interaction affects it? And if so, in which direction the outcome changes?

A growing number of laboratory experiments have tested how groups reach agreement in risky choices (Ambrus et al., 2013; Baker et al., 2008; Charness et al., 2006; Holt and Laury, 2002; Masclet et al., 2009; Shupp and Williams, 2008; Rockenbach et al., 2001). In particular, we consider two studies as illustrative in this field: Harrison et al. (2012), and Zhang and Casari (2012). The former tests risk preferences of groups of three members, where group's decision is taken with the majority rule (MR); the latter, also tests risk preferences of three-members group, but using a different aggregation rule, i.e. unanimity rule (UR). These two experiments lead to different results[3]: Harrison et al. (2012) did not find any statistical difference between individuals' and groups' preferences over risk, while Zhang and Casari (2012) found that groups tend to be more prone to the risk neutrality than individuals. What trigger these different results?

The work here presented is a replication study aimed to investigate the link between individual and group preferences towards risk. To do this, we picked lottery sets and aggregation rules from both Harrison et al. (2012) and Zhang and Casari (2012), we crossed them, in order to bring out whether there is a factor of the experimental design affecting the final group decision.

The remainder of this work is organized as follows. We first examine the most relevant papers from previous literature, in order to outline an overview of the main results reached in this field. In the third section we discuss and presents the replication experimental design and its implementation. Finally, we report our results and conclusions.

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[3] Zhang and Casari (2012) and Harrison et al. (2012) differs also for the lottery set used to elicit group and individual preferences towards risk.

2. Literature Review

In the last decade, several experiments investigated groups' risk attitudes. However, they did not achieve a univocal position. Some of them reported that groups are more risk adverse than individuals (Ambrus et al., 2013; Baker et al., 2008; Bateman and Munro, 2005; Shupp and Williams, 2008; Masclet et al., 2009). Conversely, other studies show that groups tend to be less risk adverse (Rockenbach et al., 2001; Zhang and Casari, 2012). Others do not even report significant differences (Harrison et al., 2012). It can be argued that depending on the study, results go in different directions.

These studies differ in terms of methods for eliciting risk preferences (e.g. bids, auctions, pairwise choice, etc.), interaction rules (that is, group members are allowed or not to talk), aggregation rules for collect group risk choices (e.g. majority-voting, unanimity, etc.), and even number of members per group.

We will now focus on two illustrative works: Harrison et al. (2012), and Zhang and Casari (2012). Both the studies value the risk attitude of individuals and three-members groups, using a pairwise choice mechanism inspired at Holt and Laury (2002). Nevertheless, their experimental designs differ as well as their findings.

Harrison et al. (2012) test participants in a within-subjects design experiment with 2 treatments: individual and group. In both the treatments, subjects face ten binary choices (Table 1). In each problem, subjects choose which lottery to play between one "safe" (A) and one "risky" option (B).

TABLE 1 - Payoff Table for Harrison's Experiment

Lottery A				Lottery B				EV^A	EV^B	Difference	Open CRRA interval if subject switches to lottery B
p($50)		p($40)		p($96.25)		p($2.50)					
0.1	50	0.9	40	0.1	96.25	0.9	2.50	41	11.88	29.12	$-\infty$, −1.71
0.2	50	0.8	40	0.2	96.25	0.8	2.50	42	21.25	20.75	−1.71, −0.95
0.3	50	0.7	40	0.3	96.25	0.7	2.50	43	30.62	12.37	−0.95, −0.49
0.4	50	0.6	40	0.4	96.25	0.6	2.50	44	40.00	4.00	−0.49, −0.15
0.5	50	0.5	40	0.5	96.25	0.5	2.50	45	49.37	−4.37	−0.14, 0.14
0.6	50	0.4	40	0.6	96.25	0.4	2.50	46	58.75	−12.75	0.15, 0.41
0.7	50	0.3	40	0.7	96.25	0.3	2.50	47	68.12	−21.12	0.41, 0.68
0.8	50	0.2	40	0.8	96.25	0.2	2.50	48	77.50	−29.50	0.68, 0.97
0.9	50	0.1	40	0.9	96.25	0.1	2.50	49	86.87	−37.87	0.97, 1.37
1	50	0	40	1	96.25	0	2.50	50	96.25	−46.25	1.37, ∞

Source: Harrison et al. (2012), p. 29

To every pairwise choice corresponds an interval of CRRA (Constant Relative Risk Aversion), which denotes the degree of risk aversion. Risk neutrality involves that a subject switches from A to B when EV^B is greater than EV^A. The "switching" point is used to infer individual and group risk attitudes. Therefore, when the CRRA coefficient is greater than 0, the subject is considered risk-averse, while when the CRRA coefficient less than 0, the subject is risk-lover. In this case, the "switching point" lies within the fourth and the fifth lines (Table 2).

They conduct the experiment over 108 university students, divided into 36 groups. Subjects perform two tasks – iRA and gRA – aimed at eliciting individuals' and groups' degree of risk aversion respectively. The tasks were structured as follows: iRA/gRA, and gRA/iRA.

Using extensions of traditional Tobit model, Harrison and colleagues (2012) found that individual and group risk aversion values were very close: the average CRRA coefficient is 0.57 for individual and 0.59 for groups. Thus, from the comparison between individual and group risk attitude, no significant differences emerged (Figure 1).

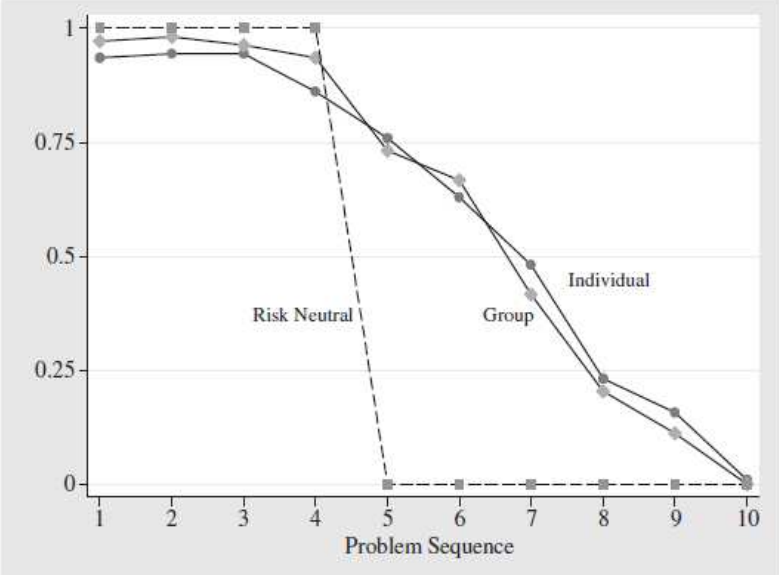

FIGURE 1 - Fraction of People Chose Safe Option A: Individual *vs*. Group
Source: Harrison et al. (2012), p. 37

In their experiment, Zhang and Casari (2012) used 15 binary lottery choices. Lottery A offered constantly 50 tokens, while lottery B presented two payoffs (0 and 150) with changing probabilities (Table 2). A perfect risk-neutral subject should switch from A to B in lottery 8. Hence, those who switch earlier are risk-loving, while those

who will switch afterwards are risk-averse.

TABLE 2 - Prospect of Lotteries in Experimental Design Implemented by Zhang and Casari (2012)

	Option A	Option B		
Lottery Number	Payoffs	Payoffs	Probability of Getting 150 Tokens	Expected Payoff of Option B
1	50	150 or 0	0	0
2	50	150 or 0	0.05	7.5
3	50	150 or 0	0.1	15
4	50	150 or 0	0.15	22.5
5	50	150 or 0	0.2	30
6	50	150 or 0	0.25	37.5
7	50	150 or 0	0.3	45
8	50	150 or 0	0.35	52.5
9	50	150 or 0	0.4	60
10	50	150 or 0	0.45	67.5
11	50	150 or 0	0.5	75
12	50	150 or 0	0.55	82.5
13	50	150 or 0	0.6	90
14	50	150 or 0	0.65	97.5
15	50	150 or 0	0.7	105
		Percentage of monotonic decision makers		

Source: Zhang and Casari (2012)

They tested 120 individuals and 40 groups who faced the same set of lotteries. In the first part, participants play the game individually, while in the second part, they were randomly divided into three-members groups. At the beginning of the group task, each member submits his/her proposal about the lottery to choose. If proposals are different, a chat box opens and members have 2 minutes to discuss via chat. Finally, they have to submit again their choices.

They have 3 attempts to reach unanimity; otherwise the default rule is applied. The default rule involved "no choice and zero earnings" for that group: that is, without unanimity the group lost every chance to win a positive amount of tokens. Following the same procedure in Harrison et al. (2012) to infer risk attitudes, Zhang and Casari (2012) also report intervals of CRRA for every decision problem (Table 3).

Comparison showed that the most number of switches occurred in lotteries 8-15. In contrast with Harrison et al. (2012), it emerged that groups were closer to risk neutrality than individuals (+4.3%), showing a so-called "risky shift" (Figure 2).

TABLE 3 - Intervals of CRRA when Subjects Switch from A to B and Frequencies of Choices for B

	Risk Preference	Individual Choices	Individual Proposals	Group Choices
Lottery Number	Range of CRRA if Switch from A to B at the Following Lottery	Frequency of Choices for B (%)	Frequency of Choices for B (%)	Frequency of Choices for B (%)
1	$r < -1.73$	0	0.8	0
2	$-1.73 < r < -1.1$	0	0	0
3	$-1.1 < r < -0.73$	1.7	0	0
4	$-0.73 < r < -0.47$	0	0	0
5	$-0.47 < r < -0.27$	1.7	0	0
6	$-0.27 < r < -0.1$	5	2.5	0
7	$-0.1 < r < 0.04$	5.8	6.7	2.5
8	$0.04 < r < 0.16$	15	20	16.7
9	$0.16 < r < 0.27$	24.2	26.7	21.7
10	$0.27 < r < 0.36$	31.7	32.5	36.7
11	$0.36 < r < 0.45$	58.3	58.3	65
12	$0.45 < r < 0.53$	68.3	67.5	80
13	$0.53 < r < 0.6$	80	80	87.5
14	$0.6 < r < 0.66$	88.3	90.8	95
15	$0.66 < r$	93.3	95	97.5
		87.5	90	95

Source: Zhang and Casari (2012)

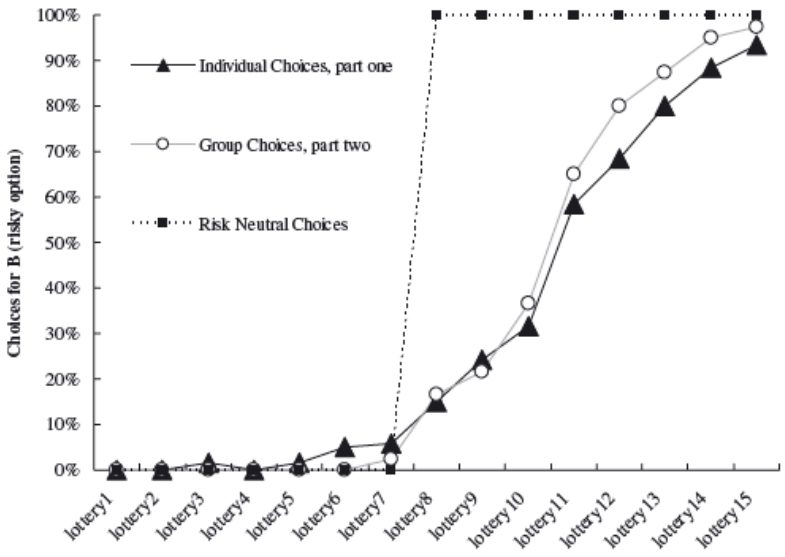

FIGURE 2 - Fractions of Individuals and Groups Choices.

Source: Zhang and Casari (2012)

According to Zhang and Casari (2012), along with the in-group interaction, the default rule of "zero earnings" must have caused the "risky shift". The "pressure" due to this rule might push even the most risk-averse subjects to endorse a riskier position just to have a positive monetary return.

3. Experimental Design and Procedure

In order to really compare these two experiments with different designs and results, and to disentangle which factor has the most influence of group choice, we replicate and merge the works by Harrison et al. (2012) and Zhang and Casari (2012) into a replication experiment.

The experiment was conducted on a heterogeneous sample of 300 students from Universitat Jaume I. The experiment is a 2x2 (lottery sets and aggregation rules) within-subjects design. Participants are involved in two treatments: individual and group. Each treatment has two sequential tasks: one with the 10 binary lottery choices by Harrison et al. (2012) and the one with the 15 binary lottery choices by Zhang and Casari (2012).

Firstly, subjects played individually. Participants were presented with the two tasks, not always in the same order. Payoffs were all converted in € (Figure 3). We showed all the 25 pairs of lotteries one by one, while participants took note of which one they preferred to play on a sheet we provided in advance (refer to Appendix for all the lotteries).

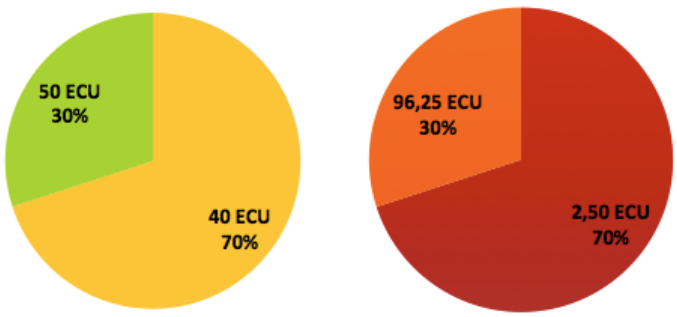

FIGURE 3 - Example of Lotteries Presented

After collecting answers subject by subject, we merged them using the majority rule in order to bring out which would be the group result when this rule is applied for

every group.

In the second part, we randomly formed groups of three people (100 groups). Groups faced the same task of the first part. In the group session, we called for unanimity for each lottery. Group members could communicate face-to-face with no time limits. Once they agreed the passed to the next decisional problems. Finally, one lottery out of 25 was randomly picked and played for real.

Overall, we run the experiment in 10 occasions. No person took part in the experiment in more than one occasion. The whole session (individual and group treatments) took on average 40 minutes.

4. Analysis and Results

We first examine results obtained when people make a decision on the 10-lotteries set (Harrison et al., 2012), both individually and then in group. The graph below (Figure 4) reports the percentage of choices for A (the safe option). It compares individual choices (circle line), group choices elicited with majority rule (triangle line) and those given by members as unanimous decision after discussion (square line). As mentioned earlier, in the lottery prospect used by Harrison et al. (2012) a perfect risk-neutral subject (cross line) should switch from A to B at the 5th decision problem. A switch in later decisions reveals risk aversion, while a switch in earlier decisions reveals risk-seeking behavior.

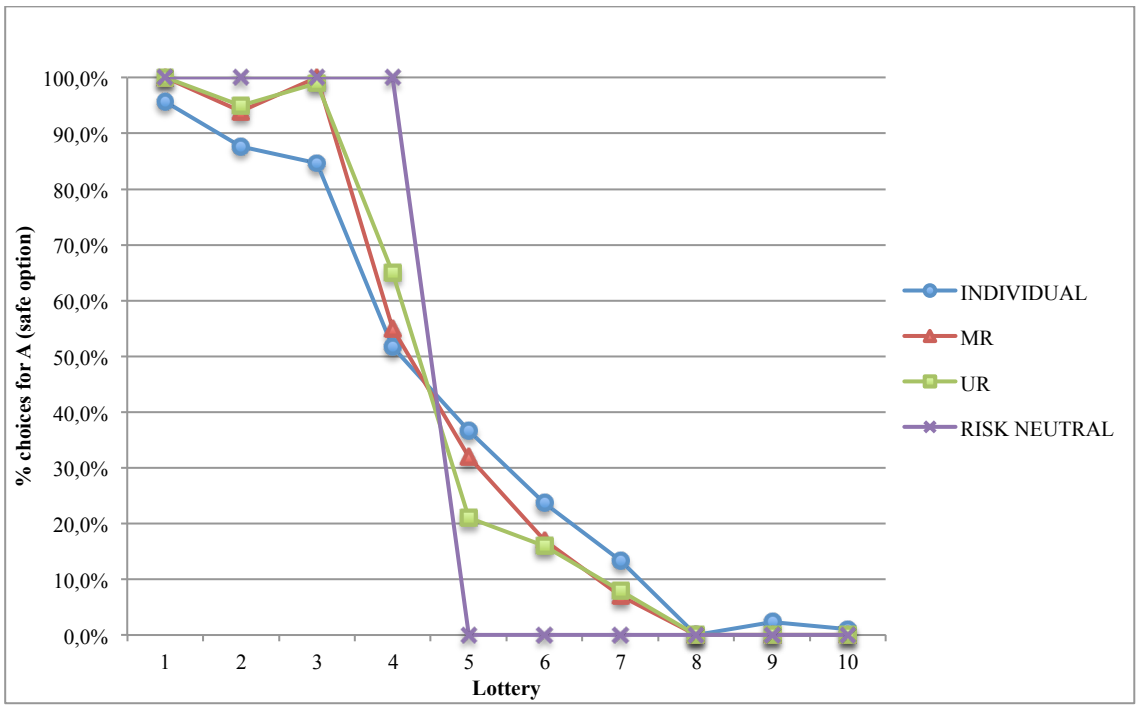

FIGURE 4 - Fraction of Individuals and Groups' who Chose A

in Harrison's Pairwise Choices

As we can notice from the graph above, individuals seem to be distant from the risk neutrality. Individuals are less risk averse than groups till the 5th decision problem. Note that, as the probability of obtaining the highest payoff increases, they appeared a little bit more risk averse. The switching point occurs at lottery 3. Indeed, the number of individuals' safer choices dramatically decreases from the 3rd to the 4th question: percentage of people who chose A passes from 84,7% in the former problem to 55% in the latter. This percentage gradually lowers between the 4th and the 8th decisional problems, while it is almost null in the last two. Also for the groups, the switching point occurs at lottery number 3 with both majority and unanimity rule.

In order to infer risk aversion of subjects and groups, we calculated midpoints of CRRA coefficient for each lottery. It is useful to clarify that a rational subject with monotonic preferences should switch from the safer to the riskier option just once and never switch back. Instead, some subjects (and groups) switched from A to B and *vice versa* more than once, showing such a kind of inconsistency or indifference over a certain range. This behavior can be due to a couple of reasons: either subjects (or groups) are genuinely or they are irrational (do not respect monotonicity) or it is just a mistake. For our purpose, we consider this behavior a "mistake" when only one switchback occurred. In these cases, we fixed the error and included that subject (or group) into the computation, since the real intention was clear. On the contrary, we labeled as "irrational" those participants who showed multiple switches and we did not considered them in the calculation, because their intentions were not so clear[4].

The average CRRA coefficient confirmed the results of the analysis. For the subjects, we found an average CRRA coefficient of −0.37, while it amounts to −0.40 for MR and UR choices[5]. These values highlight that all the choices are quite less risk averse than a risk neutral subject, but they are all close to each other. Indeed, individual and group risk aversion is not statistically different. The two-sample Kolmogorov-Smirnov test on the individuals' and groups' distributions of switching points retains the null hypothesis of equality[6].

[4] On this procedure, see "Inconsistent Choices in Lottery Experiments: Evidence from Rwanda", by S. Jacobson and R. Petrie, 2007

[5] For this evaluation, we took into account 276 individuals, 94 MR-groups and 95 UR-groups.

[6] Individual distribution is not statistically different from MR-groups (n=300, m=100, p>.05) and from UR-groups (p>.05) when using the lottery set from Harrison et al. (2012).

Let us pass to analyze the results when using the 15 binary lotteries from Zhang and Casari (2012). As we can notice from Figure 5, the line of individuals', MR and UR choices approximately retrace the same path.

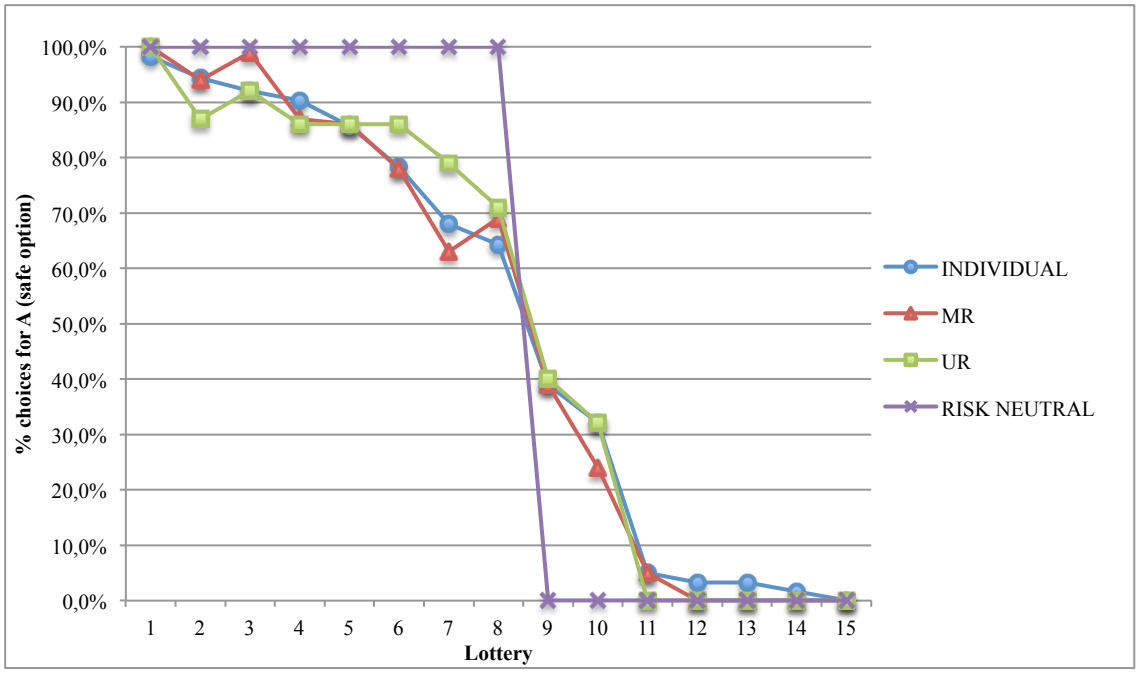

FIGURE 5 - Fraction of Individuals and Groups' who Chose A in Zhang and Casari's Pairwise Choices

This phenomenon seems to confirm the conclusions drawn by Harrison et al. (2012), with a different lottery prospect. The graph above suggests that individuals, MR and UR choices are almost all slightly more risk-averse than a perfect risk-neutral subject. Indeed, the switching point occurs a bit later (between the 8th and the 9th line rather than at 8th one). In lotteries 1-6 risk-seeking behavior is rare. Some differences come from lotteries 6-9 where UR choices seem to be a little more risk-averse than individuals and MR choices.

However, as in the first task, these trends are not statistically different. The Kolmogorov-Smirnov test on switching point distributions between individuals and groups retains the null hypothesis of equality[7].

The calculation of the coefficient of CRRA supports these findings. The average CRRA coefficient for individuals is -0.40, close to MR groups one (-0.39) and UR

[7] Individual distribution is not statistically different from MR-groups (n=300, m=100, p>.05) and from UR-groups (p>.05) when using the lottery set from Zhang-Casari (2012).

groups (-0.38)[8]. Actually, the most part of individuals (64,3%) switched between at the 8th pair of lotteries, as the MR groups almost did the same (69%), and UR groups (71%).

Overall, the effects of aggregation rule and lottery set display the same pattern in both the tasks[9].

5. Conclusions

In this research, we first replicated Harrison et al. (2012), and Zhang and Casari (2012) on a new sample. Then, we tested whether and to what extant different lottery sets and aggregation rules have an impact on group choices. In line with Harrison et al. (2012), our results confirm that no significant differences occur between individuals and group risk aversion, regardless of the aggregation rule used to elicit the group choices. However, these results are in contrast with Zhang and Casari (2012), who found that group choices are more risky than individual choices. Since the "risk-shift" is not due to the lottery set, neither to the aggregation rule, indeed we can conclude that it is driven by the "zero earnings" default rule to resolve disagreement. Indeed, the "zero earnings" default rule impulses people to find an agreement, and to make a choice even though it is riskier, because a risky choice is better than no choice. Instead, in our experiment, group members have no time limits to discuss and find a unanimous choice.

All in all we can conclude that there are no differences in individuals and groups decisions toward risk.

[8] For this calculation we consider 285 individuals, 100 MR-groups and 94 UR-groups.

[9] With the lottery set from Harrison et al. (2012), on average 40% of individual choices were safe, with respect to 40,5% of MR-groups and 40,4% of UR-groups. With the lottery set from Zhang-Casari (2012), on average 75,6% of individual choices were safe choices, with respect to 74,4% of MR-groups and 76% of UR-groups.

Appendix

TABLE 1 - First set of Lotteries in the Experiment (Harrison et. al., 2012)

Lottery A		**Lottery B**	
50 ECU	**40 ECU**	**96,25 ECU**	**2.50 ECU**
10%	90%	10%	90%
20%	80%	20%	80%
30%	70%	30%	70%
40%	60%	40%	60%
50%	50%	50%	50%
60%	40%	60%	40%
70%	30%	70%	30%
80%	20%	80%	20%
90%	10%	90%	10%
100%	0%	100%	0%

TABLE 2 - Second Set of Lotteries in the Experiment (Zhang and Casari., 2012)

Lottery A	**Lottery B**	
50 ECU	**150 ECU**	**0 ECU**
100%	5%	95%
100%	10%	90%
100%	15%	85%
100%	20%	80%
100%	25%	75%
100%	30%	70%
100%	35%	65%
100%	40%	60%
100%	45%	55%
100%	50%	50%
100%	55%	45%
100%	60%	40%
100%	65%	35%
100%	70%	30%

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