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Comparing Group and Individual Choices under Risk and Ambiguity: An Experimental Study

Marielle Brunette¹, Laure Cabantous² and Stéphane Couture³

Abstract

In this paper, we build on the emerging literature on group decision-making to study the so-called 'group shift' effect, i.e., groups are less risk-averse than individuals. Our study complements past research in two ways. First, we study the group shift effect under two sources of uncertainty, namely risk where probabilities are known, and ambiguity where probabilities are imprecise. Second, we study the impact of the group decision rule (unanimity and majority) on group shift. Results from a lottery-choice experiment show a general tendency for the group shift effect, regardless of the decision rule. The group shift effect, however, is found to be significant only under risk in the unanimity treatment. Our study hence provides a clear test of the effect of the decision rule on the group shift effect under both risk and ambiguity.

Keywords

Collective decision, unanimity, majority, preferences, risk, ambiguity

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Comparing Group and Individual Choices under Risk and Ambiguity: an Experimental Study

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Abstract

In this paper, we build on the emerging literature on group decision-making to study the so-called ‘group shift’ effect, i.e., groups are less risk-averse than individuals. Our study complements past research in two ways. First, we study the group shift effect under two sources of uncertainty, namely risk where probabilities are known, and ambiguity where probabilities are imprecise. Second, we study the impact of the group decision rule (unanimity and majority) on group shift. Results from a lottery-choice experiment show a general tendency for the group shift effect, regardless of the decision rule. The group shift effect, however, is found to be significant only under risk in the unanimity treatment. Our study hence provides a clear test of the effect of the decision rule on the group shift effect under both risk and ambiguity.

Keywords: collective decision, unanimity, majority, preferences, risk, ambiguity.

JEL classification: C91, C92.

1. Introduction

Most experimental research on decision-making has focused on individual rather than group choices (Camerer, 1995). Yet, in many cases, economic and business decisions are made by groups rather than by individuals (Kocher et al., 2006; Deck et al., 2010). To address this gap, a growing literature in economics builds on psychological research (Kerr et al., 1996) to investigate group decision-making (Blinder and Morgan, 2005; Kocher et al., 2006; Baker et al., 2008; Shupp and Williams, 2008; Masclet et al., 2009).

This emerging literature reveals the presence of a ‘group shift’ effect, i.e., groups are found to be less risk-averse than individuals (Baker et al., 2008; Gurdal and Miller, 2008; Sheremeta and Zhang, 2010; Zhang and Casari, 2010). Some studies, however, qualify these results. For instance, Shupp and Williams (2008) and Masclet et al. (2009) reported that the group shift might vary with the riskiness of the choice: groups are more risk-averse than individuals when the probability of gain is high (high-risk situations), and tend to be less risk-averse when the probability of gain is low (low-risk situations). In addition, some studies suggest that the group shift might also depend on the type of decision rule that the group implements. For instance, Harrison et al. (2007) studied the group shift where the group implemented a majority rule instead of a unanimity rule, as most studies do (Rockenbach et al., 2007; Shupp and Williams, 2008; Baker et al., 2008; Masclet et al., 2009). They reported no difference between individual and group attitudes towards risk in a lottery-choice experiment.

In this paper, we complement this research by comparing the group shift effect generated by a majority rule and a unanimity rule. In addition, we study the group shift effect under both risk (where probabilities are known) and ambiguity (where probabilities are only vaguely known). Our research therefore also contributes to ambiguity research (Camerer and Weber, 1992; Rubaltelli et al., 2010; Wakker, 2010), which so far has focused on individuals (rather

than groups) attitudes towards ambiguity. Results from a lottery-choice experiment show that the group shift effect is prevalent only under risk when groups implement a unanimity decision rule.

The article is structured as follows. Section 2 describes the experiment, Section 3 is devoted to preliminary data analysis, and Sections 4, 5 and 6 present the results. Section 7 contains the conclusion.

2. Experiment

2.1. Experimental Design

In order to compare the group shift effect generated by a majority rule and a unanimity rule, our experiment consisted of two treatments: a majority treatment and a unanimity treatment (between-subject variable). In both treatments, all subjects participated in a lottery-choice experiment with two tasks, an individual and a collective decision task, whose order of presentation was random. All participants were also exposed to two uncertain contexts, risk and ambiguity. In the individual task, the order of presentation of the uncertain context was random. In the collective task, due to matching constraints, all participants started with risky prospects followed by ambiguous prospects. The tasks in the two treatments were identical and involved a sequence of ten binary choices with lotteries in the gain domain, as explained below.

2.2. Decision Tasks under Risk: The Multiple Price List Procedure

We used the Multiple Price List (MPL) procedure of Holt and Laury (2002) to elicit attitudes towards risk in both the individual and the collective tasks. The MPL procedure is one of the most common approaches used to elicit risk attitudes (Goeree et al., 2003; Eckel and Wilson, 2004; Harrison et al., 2005; Holt and Laury, 2005; Andersen et al., 2006; Bruner, 2007; Eckel and Grossman, 2008).

Individual decision task. As Table A1 in the appendix shows, each participant is presented with ten sequential choices between two lotteries. For each binary choice, the participant has to choose between a safe option (Lottery A) and a risky option (Lottery B). By definition, a risk-neutral subject switches from one type of lottery to the other when the two lotteries have the same expected value. In Table A1, the risk neutrality threshold is 4 (i.e., risk-neutral subjects switch between the fourth and fifth choices).

Collective decision task. We elicited a collective attitude to risk by using the same MPL procedure as in the individual task (see Table A1 in the appendix). We randomly created three-person groups that changed after each binary choice. For the majority rule, a group choice automatically emerged because there were two options and three participants.

For the unanimity rule, we implemented an iterative process. For each binary choice, group members could play up to five trials. When the output of a trial was a unanimous decision, i.e., the three members chose the same option, new groups were created to address the next binary choice. If no unanimous choice was reached, the group members had the opportunity to address the same binary choice in a new trial. At the end of the fifth trial, if the three members of a group had not chosen the same option, a ‘disagreement’ message appeared on the screen. New three-person groups were then formed for the next binary choice. Hence, our experiment differs from that of Masclet et al. (2009) in that the computer does not randomly select a choice at the end of the fifth trial when the group does not reach a consensus.

2.3. Decision Tasks under Ambiguity: the Procedure of Chakravarty and Roy (2009)

Two main types of procedures exist to elicit decision-makers’ attitudes towards ambiguity: model-free procedures (Cohen et al., 2010) and procedures rooted in a specific theoretical model (Halevy, 2007). For instance, the procedure of Chakravarty and Roy (2009) is consistent with the model of risk and ambiguity attitudes of Klibanoff, Marinacci and Mukerji

(2005). In this research, we used the procedure of Chakravarty and Roy (2009) because it extends the procedure of Holt and Laury (2002) to the ambiguous context. This procedure thus ensures a greater comparability with the risky context than other procedures.

Table A2 in the appendix shows the series of ten sequential choices with ambiguous prospects faced by the participants. Each choice consists of a non-ambiguous option (option A) and an ambiguous option (option B). In this table, an ambiguity-neutral subject is indifferent between the two options at the fifth binary choice. It is noteworthy that – as in the risky context – the series of ten sequential binary choices were played by all the participants in both the individual and the collective task.

2.4. Participants and Incentives

The experiment was conducted at the Laboratory of Forest Economics in Nancy (France). Sixty students (31 men and 29 women; average age = 21.5 years) were recruited from different study programmes. The experiment was computerised and scripts were programmed using the z-tree platform (Fischbacher, 2007). Each session lasted approximately two hours and ended with a short demographic survey (age, sex and professional activity).

At the end of the experiment, two choices were randomly selected by the computer, one from the individual task and one from the collective task. For each selected choice, the computer determined the participant's payoff. The sum of the two payoffs determined the final payment of the respondent. In our experiment, the payments of subjects varied between 0 and 26 Euros with an average of 11 Euros.

3. Preliminary Data Analysis

3.1. Inconsistent Behaviours

The proportion of multiple switching behaviours varied across cases from 5% to 10%. Such proportions are consistent with other MPL studies. For instance, the rate of multiple switching behaviours is 13.2% in Holt and Laury (2002) and 12.9% in Eckel and Wilson (2004).

Andersen et al. (2006) reported that 5.8% of their subjects switched multiple times when allowing for the indifference option (chosen by 24.3% of subjects). Recent studies have found higher rates of multiple switching behaviours (e.g., 20% in Bruner et al., 2008, and 55% in Jacobson and Petrie, 2009). Most studies usually discard non-consistent choices when their proportion is relatively small. We therefore decided to run our analyses on consistent behaviours only.

3.2. Estimates of Risk and of Ambiguity Aversion Coefficients

Participants' choices in the MPL task make it possible to quantify the relative risk aversion parameter of their utility function, while participants' choices in the procedure of Chakravarty and Roy (2009) make it possible to estimate their attitudes towards ambiguity.

Risk aversion coefficient. We used a Constant Relative Risk Aversion (CRRA) characterisation of risk attitudes, with $U(x) = x^{(1-r)}/(1-r)$, for $x > 0$, where $r \neq 1$ is the CRRA coefficient. The switching point in the MPL list provides a direct inference of a CRRA index interval.

Ambiguity aversion coefficient. As explained above, the procedure of Chakravarty and Roy (2009) is consistent with KMM's representation of risk and ambiguity attitudes (Klibanoff et al., 2005). This representation differentiates attitudes towards risk from attitudes towards ambiguity as follows:

$$KMM(x) = E\phi(EU(x))$$

where the function U characterises the participant's attitude towards risk and the function ϕ characterises his/her attitude towards ambiguity. The number of non-ambiguous lottery choices sets the bounds for the ambiguity aversion parameter (see parameter s in Table A4 in the appendix).

Tables A3 and A4 in the appendix provide the results of these estimations and give the distributions of risk aversion and ambiguity aversion parameters, respectively. We used these

tables to create Tables 1 and 2 below that classify participants into three risk or ambiguity categories, respectively: (1) risk or ambiguity lover; (2) risk or ambiguity neutral and (3) risk or ambiguity averse.

4. Results under Risk

4.1. Individual and Group Attitudes towards Risk

We first need to check whether our participants exhibit the usual behaviour in the gain domain under risk, i.e., risk aversion. Table 1 below shows that a large proportion of individuals and groups are risk-averse in both treatments, i.e., the mean numbers of non-risky choices are consistently greater than four, the risk neutrality threshold in the MPL procedure.

INSERT TABLE 1 ABOUT HERE

A series of t-tests shows that individuals are significantly averse to risk in both treatments. In the Majority treatment, the mean number of non-risky choices made by individuals (5.97) is significantly higher than the risk neutrality threshold of 4 ($t_{28} = 6.225$; $p = 0.000$). In the Unanimity treatment, individuals made an average of 5.46 non-risky choices, which is significantly higher than the risk neutrality threshold ($t_{27} = 5.875$; $p = 0.000$). These results are consistent with past studies that show that individuals are averse to risk in the gain domain (Binswanger, 1980; Holt and Laury, 2002).

At the group level, we also found significant risk aversion. In the Majority treatment, groups made an average of 5.79 non-risky choices, which is significantly higher than the neutrality threshold of four non-risky choices ($t_{29} = 10.256$; $p = 0.000$). In the Unanimity treatment, they also made significantly more than four non-risky choices ($t_{29} = 4.642$; $p = 0.000$). These results are consistent with past studies of group attitude towards risk, which revealed that groups are risk-averse in the gain domain with a majority rule (Harrison et al., 2007) and with a unanimity rule (Masclét et al., 2009).

4.2. Group Shift under Risk

We designed the experiment so as to test whether groups are less risk-averse than individuals, i.e., the group shift hypothesis (Baker et al., 2008; Gurdal and Miller, 2008; Sheremeta and Zhang, 2010; Zhang and Casari, 2010). Table 1 above, which gives the mean (and median) numbers of non-risky choices, reveals a tendency for groups to be less risk-averse than individuals in both treatments, i.e., groups tend to make fewer non-risky choices than individuals.

A Wilcoxon signed-rank test for paired samples confirms that groups implementing a unanimity decision rule (4.89) make significantly fewer non-risky choices than individuals (5.46). Groups in the Unanimity treatment are thus found to be significantly less risk-averse than individuals ($Z = -2.607$; $p = 0.009$). Groups implementing a majority decision rule (5.79) however, do not significantly make fewer non-risky choices than individuals (5.97). They are therefore not significantly less risk-averse than individuals ($Z = -0.420$; $p = 0.675$). Thus, although we find a tendency for the group shift in both treatments, the group shift is significant only in the Unanimity treatment.

4.3. Group Decision Rule and Size of the Risk Group Shift

Table 1 also suggests that groups that implement the majority rule are more risk-averse (5.79) than groups implementing the unanimity rule (4.89). Results from a Mann-Whitney test for independent samples support this result ($Z = -3.028$, $p = 0.002$).

Because we observed that participants in the Majority treatment tended to be more risk-averse than participants in the Unanimity treatment in both the individual and collective tasks, we computed a relative measure of group shift¹. For each treatment, we computed the absolute value of the difference between the average number of non-risky choices by

individuals and by groups. This value is equal to 0.18 in the Majority treatment and to 0.57 in the Unanimity treatment. A non-parametric Mann-Whitney test shows that the difference between these two values is not significant ($Z = -1.206$; $p = 0.228$). This confirms the above results by showing that even though the unanimity rule tends to generate a higher group shift, the type of decision rule does not have a significant impact on the size of the group shift.

5. Results under Ambiguity

5.1. Individual and Group Attitudes towards Ambiguity

Ambiguity studies usually report that individuals tend to be ambiguity-averse or ambiguity-neutral in the gain domain (Camerer and Weber, 1992; Di Mauro and Maffioletti, 2004; Chakravarty and Roy, 2009; Wakker, 2010). To the best of our knowledge, no study has yet focused on the level of ambiguity aversion of groups. Table 2 below shows that in both treatments, a large proportion of individuals and groups is ambiguity-averse. The mean numbers of non-ambiguous choices are indeed consistently greater than five, the risk neutrality threshold in the procedure of Chakravarty and Roy (2009).

 INSERT TABLE 2 ABOUT HERE

A series of t-tests shows that individuals are significantly averse to ambiguity in the Majority treatment but not in the Unanimity one. In the Majority treatment, the mean number of non-ambiguous choices made by individuals (6.21) is significantly higher than the risk neutrality threshold of five non-ambiguous choices ($t_{27} = 3.716$; $p = 0.001$). In the Unanimity treatment, however, the average number of non-ambiguous choices made by individuals (5.38) is not significantly higher than the ambiguity neutrality threshold ($t_{28} = 1.217$; $p =$

¹ Note that although individuals in the Majority treatment tend to be slightly more risk-averse (5.97) than individuals in the Unanimity treatment (5.46), a Mann-Whitney test for independent samples showed that the difference is not significant ($Z = -1.140$; $p = 0.254$).

0.234). These results are partially consistent with past studies that show that individuals are ambiguity-averse or ambiguity-neutral in the gain domain.

At the group level, we also find that the tendency to ambiguity aversion is significant in the Majority treatment only. In this treatment, groups made an average of 5.60 non-ambiguous choices, which is significantly higher than the neutrality threshold of five non-ambiguous choices ($t_{29} = 3.168$; $p = 0.04$). In the Unanimity treatment, however, although groups made an average of 5.20 non-ambiguous choices, they are not significantly averse to ambiguity ($t_{29} = 1.185$; $p = 0.246$).

5.2. Group Shift under Ambiguity

We now compare individual and group attitudes towards ambiguity to test whether the group shift effect usually found under risk is also true under ambiguity; i.e., groups are less ambiguity-averse than individuals. Table 2 above shows a tendency for groups to be less ambiguity-averse than individuals in both treatments, regardless of the group decision rule. Specifically, in the Majority treatment, groups made an average of 5.60 non-ambiguous choices, and individuals made an average of 6.21 non-ambiguous choices. In the Unanimity treatment, groups also made fewer non-ambiguous choices (5.20) than individuals (5.38).

A series of Wilcoxon signed-rank tests for paired samples however, shows no significant difference between group and individual attitudes towards ambiguity in either the Majority ($Z = -0.498$; $p = 0.619$) or the Unanimity ($Z = -1.641$; $p = 0.101$) treatment. Thus, although our experiment shows that there is a tendency towards the group shift effect under ambiguity in both treatments, the group shift effect is not large enough to be significant in any treatment. Groups are thus not found to be less ambiguity-averse than individuals.

5.3. Group Decision Rule and Size of the Ambiguity Group Shift

Table 2 also shows that groups implementing a majority rule make more non-ambiguous choices (5.60) than groups implementing a unanimity rule (5.20). This suggests that the majority rule generates more ambiguity aversion than the unanimity rule. A Mann-Whitney test for independent samples, however, shows that the difference is not significant ($Z = -1.313$; $p = 0.189$).

We observed that participants in the Majority treatment tend to be more ambiguity-averse than participants in the Unanimity treatment in both the individual and the collective tasks². As in the risk context, we therefore computed a relative measure of group shift. This value is equal to 0.61 in the Majority treatment and to 0.18 in the Unanimity treatment. A non-parametric Mann-Whitney test shows that the difference between these two values is not significant ($Z = -1.038$; $p = 0.299$). It is interesting to observe that under risk, the Unanimity treatment tends to generate the greater group shift effect (and actually, the group shift is significant under the Unanimity rule only), whereas under ambiguity, the Majority treatment tends to generate the greater group shift effect (although no group shift is significant). This suggests the possibility of an interaction effect between the type of decision rule and the type of uncertainty.

6. Further results

6.1. Convergence towards Unanimity

In the Unanimity treatment, groups had up to five iterations to reach a unanimous decision. Although our procedure slightly differs from Masclet et al. (2009)³, our results are consistent

² Note that individuals in the Majority treatment tend to be slightly more ambiguity-averse (6.21) than individuals in the Unanimity treatment (5.38). A Mann-Whitney test for independent samples showed that the difference is significant ($Z = -1.929$, $p = 0.054$).

³ In this experiment, the computer did not randomly choose a decision at the end of the fifth iteration if the group did not reach a unanimous decision.

with theirs. In addition, we extended these results to the ambiguity context, as explained below.

In both the risky and the ambiguous context, Figures 1 and 2 below show that groups reached a unanimous decision at the first iteration in decision 3 only. In all the other decisions, two or more iterations were needed to reach a unanimous decision – when such a decision emerged. It is interesting to note that the two figures report similar percentages of disagreement across the probability range (i.e., decision number). They show, in particular, that percentages of disagreement are higher for middle probability decisions (i.e., intermediate decisions 4 to 7) than for low- and high-probability decisions (decisions 1 to 3 and 8 to 10, respectively). For example, we observed 80% of disagreements in the first iteration for decisions 5 or 6 in the risky context, and 70% of disagreements in the first iteration for decisions 5 or 7 in the ambiguity context. In contrast, the frequency of disagreement is equal to 10% in the first iteration for decision 10 in both the risky and ambiguous context.

INSERT FIGURES 1 and 2 ABOUT HERE

The two figures also clearly show that the proportion of disagreement decreases with the number of iteration rounds. In most cases, the iterative process thus allowed groups to converge towards a unanimous decision. For instance, the probability of disagreement in the fifth iteration for the risky decision 5 is equal to 20%, whereas it is 80% in the first iteration. These results are similar to those of Masclet et al. (2009) who observed that for decision 7, the probability of disagreement is 75% in the first iteration and decreases to 12% in the fifth iteration. Under ambiguity, the probability of disagreement at decision 7 drops from 70% in the first iteration to 10% in the fifth iteration.

Figure 3 below gives the changes in attitudes towards risk and ambiguity in the individual and collective tasks. It shows that almost 40% of the participants exhibited the

same attitude towards risk both in the individual and the collective tasks. There are almost as many participants who were less risk-averse in the collective task than in the individual task (32%), as there are participants who were more risk-averse in the collective task than in the individual task (28%). Figure 3 also shows that attitudes towards ambiguity were less stable than attitudes towards risk. Only a minority of participants (24%) had the same attitude towards ambiguity in the individual task and in the collective task. The participants whose attitude towards ambiguity changed across tasks were evenly split: 38% were less risk-averse in the individual task than in the collective task, and 38% were more risk-averse in the collective task than in the individual task.

 INSERT FIGURE 3 ABOUT HERE

6.2. Correlation between Attitudes towards Risk and towards Ambiguity

In the individual task, we find a positive correlation⁴ between the number of non-risky choices and non-ambiguous choices (Spearman = 0.39; $p = 0.004$). This result is consistent with those of Chakravarty and Roy (2009), which show a positive (and significant) correlation between individuals' attitudes towards risk and ambiguity. In the collective task, we do not find any significant correlations⁵ between risk and ambiguity attitudes in either the Majority treatment (Spearman = -0.214; $p = 0.255$) or the Unanimity treatment (Spearman = 0.140; $p = 0.461$).

7. Conclusion and Discussion

In this paper, we contribute to the empirical analysis of group shift effect in two ways: we study the impact of the decision rule on the group shift and we also consider the impact of the source of uncertainty (risk or ambiguity).

⁴ We find the same result with a Pearson correlation coefficient.

⁵ We find the same result with a Pearson correlation coefficient.

First, our comparison of the group shift effect under a unanimity and a majority decision rule reconciles past results that reported mixed evidence. Studies that used a unanimity rule usually reported a significant group shift effect (Baker et al., 2008; Gurdal and Miller, 2008; Sheremata and Zhang, 2010; Zhang and Casari, 2010), whereas studies that used a majority rule usually did not find a significant group shift effect (Harrison et al., 2007). By showing that the group shift effect is significant only under risk in the unanimity treatment, our experiment provides a clear test of the impact of the decision rule on the group shift under risk.

Second, our experiment extends past research on group decision-making to ambiguous contexts, i.e., when probabilities are unknown. The large number of papers recently published on ambiguity (Abdellaoui et al., 2010; Cabantous et al., 2011; Cabantous, 2007; Gajdos et al., 2008; Hey et al., 2010; Klibanoff et al., 2005; Machina, 2009; Neilson, 2010; Rubaltelli et al., 2010; Seo, 2009; Snow, 2010; Wakker, 2010) reveals the interest of economists for a better understanding of attitudes towards ambiguity. Yet, this literature has almost exclusively focused on individual decision-making. To our knowledge, this paper is the first attempt to study group decisions, and the group shift, in particular, under ambiguity. Even though we find a tendency for group shift under ambiguity, regardless of the decision rule, these group shift effects were not statistically significant. This finding is important because ambiguity is often considered to be an additional risk compared to a risky situation. Our results, however, suggest that this might not be the case.

This paper can be extended in several ways. For example, future research could focus on the impact of the size of the group on the group shift. Most studies so far have used three-person groups (Baker et al., 2008; Masclet et al., 2009) but the size of the group could matter. Other researchers could also study the group shift in more naturalistic settings, where group members can discuss and interact before making a decision. In our experiment, like in

Masclet et al. (2009), participants did not interact with each other when making decisions under group conditions. Yet, it would be interesting to study the group shift when interaction between group members is allowed such as cheap talk (Baker et al., 2008).

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TABLES

Table 1. Individual and group attitudes towards risk

Treatment	Decision type	Risk-loving (%)	Risk-neutral (%)	Risk-averse (%)	Mean (median) # of non-risky choices
Majority	Indiv. (n = 29)	2 (7%)	4 (14%)	23 (79%)	5.97 (6)
	Group (n = 30)	0 (0%)	3 (10%)	27 (90%)	5.79 (6)
Unanimity	Indiv. (n = 28)	2 (7%)	5 (18%)	21 (75%)	5.46 (6)
	Group (n = 30)	3 (10%)	9 (30%)	18 (60%)	4.89 (5)

Table 2. Individual and group attitudes towards ambiguity

Treatment	Decision type	Ambiguity-loving (%)	Ambiguity-neutral (%)	Ambiguity-averse (%)	Mean (median) # of non-ambiguous choice
Majority	Indiv. (n = 28)	4 (14%)	7 (25%)	17 (61%)	6.21 (6)
	Group (n = 30)	3 (10%)	13 (43%)	14 (47%)	5.60 (5)
Unanimity	Indiv. (n = 29)	9 (31%)	11 (38%)	9 (31%)	5.38 (5)
	Group (n = 30)	9 (30%)	7 (23%)	14 (47%)	5.20 (5)

FIGURES

Figure 1. Frequency of disagreements in groups for risky choices

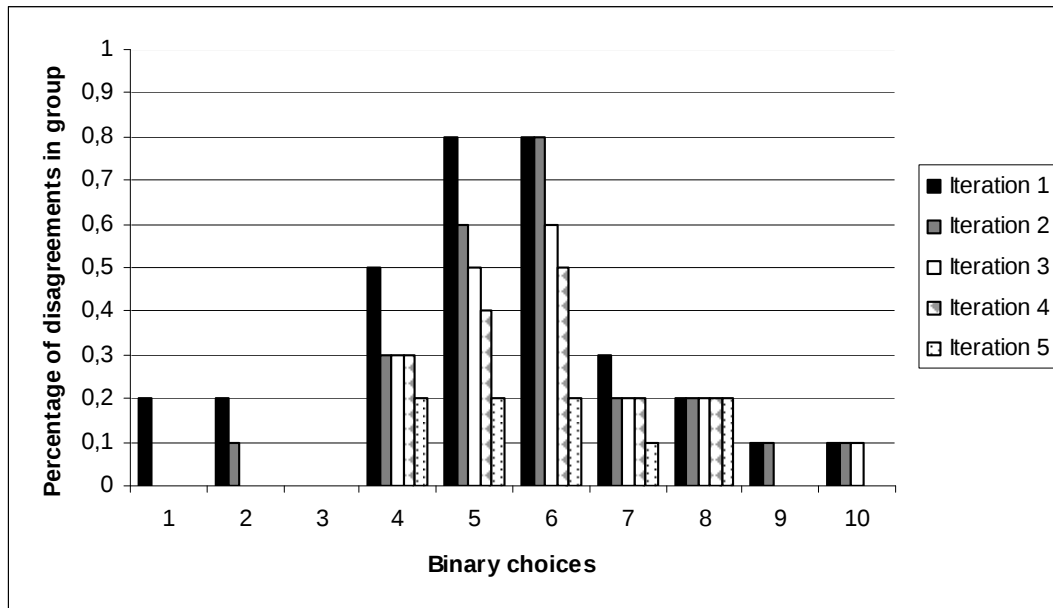
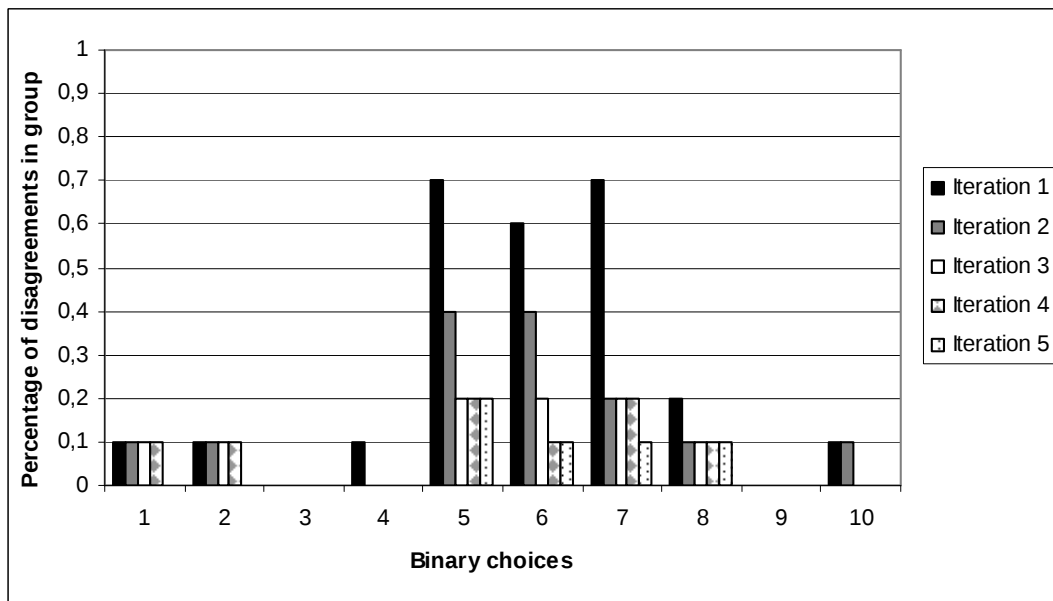


Figure 2. Frequency of disagreements in groups for ambiguous choices



Figures 1 and 2 give the percentages of ‘disagreement’ (i.e., groups do not reach a unanimous decision) by decision and by iteration. Note that the ten binary choices are presented, ranging from low probability to high probability.

Figure 3. Link between individual and collective attitudes towards risk and ambiguity

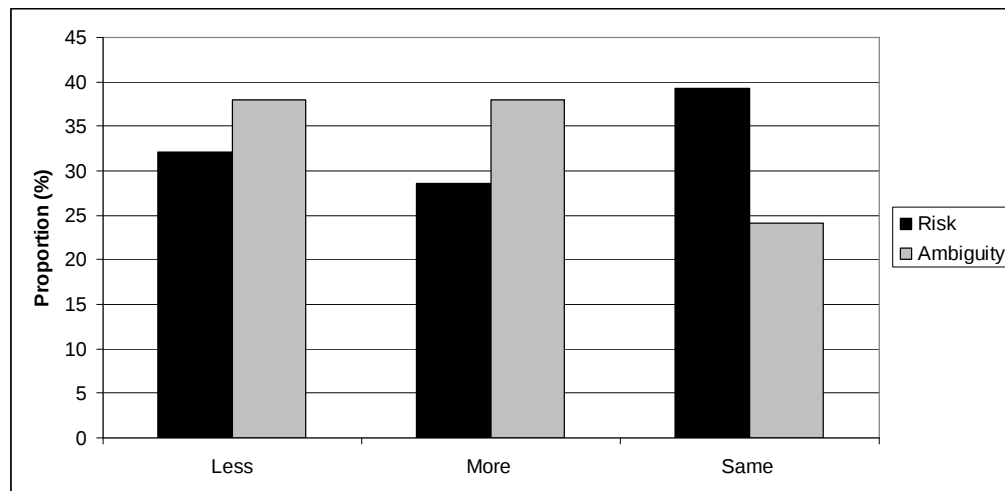


Figure 3 gives the percentages of individuals exhibiting less, more or the same aversion in collective tasks compared to individual ones, depending on the context of uncertainty.

APPENDIX

Table A1. Individual choices with risky prospects in the gain domain

	Option A				Option B				Choice
	Prob. P	Gains	Prob. (1-P)	Gains	Prob. P	Gains	Prob. (1-P)	Gains	
1	10%	7 €	90%	5 €	10%	13 €	90%	0 €	A B
2	20%	7 €	80%	5 €	20%	13 €	80%	0 €	A B
3	30%	7 €	70%	5 €	30%	13 €	70%	0 €	A B
4	40%	7 €	60%	5 €	40%	13 €	60%	0 €	A B
5	50%	7 €	50%	5 €	50%	13 €	50%	0 €	A B
6	60%	7 €	40%	5 €	60%	13 €	40%	0 €	A B
7	70%	7 €	30%	5 €	70%	13 €	30%	0 €	A B
8	80%	7 €	20%	5 €	80%	13 €	20%	0 €	A B
9	90%	7 €	10%	5 €	90%	13 €	10%	0 €	A B
10	100%	7 €	0%	5 €	100%	13 €	0%	0 €	A B

Table A2. Individual choices with ambiguous prospects in the gain domain

Choose a colour: BLACK ○ WHITE ○

	Option A: urn A		Option B: urn B		Choice
	In urn A, the distribution of balls		In urn B, the possible distribution		
	is 5 black and 5 white		of balls is not known		
	<i>The chosen colour</i>	<i>The chosen colour</i>	<i>The chosen colour</i>	<i>The chosen colour</i>	
	<i>is obtained</i>	<i>is not obtained</i>	<i>is obtained</i>	<i>is not obtained</i>	
	Gains	Gains	Gains	Gains	
1	13 €	0 €	9 €	0 €	A B
2	12 €	0 €	9 €	0 €	A B
3	11 €	0 €	9 €	0 €	A B
4	10 €	0 €	9 €	0 €	A B
5	9 €	0 €	9 €	0 €	A B
6	8 €	0 €	9 €	0 €	A B
7	7 €	0 €	9 €	0 €	A B
8	6 €	0 €	9 €	0 €	A B
9	4 €	0 €	9 €	0 €	A B
10	2 €	0 €	9 €	0 €	A B

Table A3. Risk preference classification based on lottery choices

Number of safe choices	Bounds for relative risk aversion $U(x)=x^{1-r}/1-r$	Classification	Individual			Collective		
			Group A	Group B	All	Group A (majority)	Group B (unanimity)	All
0 and 1	$r < -0.95$	Highly risk-loving						
2	$-0.95 < r < -0.49$	Very risk-loving						
3	$-0.49 < r < -0.15$	Risk-loving	2 (7)	2 (7)	4 (7)		3 (10)	3 (5)
4	$-0.15 < r < 0.15$	Risk-neutral	4 (14)	5 (18)	9 (16)	3 (10)	9 (30)	12 (20)
5	$0.15 < r < 0.41$	Slightly risk-averse	6 (21)	6 (21)	12 (21)	8 (27)	6 (20)	14 (23)
6	$0.41 < r < 0.68$	Risk-averse	5 (17)	10 (36)	15 (26)	10 (33)	12 (40)	22 (37)
7	$0.68 < r < 0.97$	Very risk-averse	8 (27)	3 (11)	11 (19)	9 (30)		9 (15)
8	$0.97 < r < 1.37$	Highly risk-averse	2 (7)	2 (7)	4 (7)			
9 and 10	$1.37 < r$	Stay in bed	2 (7)		2 (4)			
Proportion of risk-averse subjects ($r > 0.15$)			23 (79)	21 (75)	44 (77)	27 (90)	18 (60)	45 (75)

A value of the risk aversion parameter equal to 0 indicates risk neutrality; negative values indicate risk-loving, and positive values indicate risk aversion.

Table A4. Ambiguity preference classification based on lottery choices

Number of non-ambiguous choices	Bounds for ambiguity aversion $KMM(x)=Ej(EU(x))$ with $j(x)=x^s$	Classification	Individual			Collective		
			Group A	Group B	All	Group A (majority)	Group B (unanimity)	All
0	$s > 1.92$	Extremely amb.-loving						
1	$1.92 \leq s < 1.59$	Highly amb.-loving						
2	$1.59 \leq s < 1.35$	Very amb.-loving						
3	$1.35 \leq s < 1.15$	Amb.-loving	1 (4)	2 (7)	3 (5)			
4	$1.15 \leq s < 1$	Slightly amb.-loving	3 (11)	7 (24)	10 (18)	3 (10)	9 (30)	12 (20)
5	$1 \leq s < 0.86$	Amb.-neutral	7 (26)	11 (38)	18 (32)	13 (43)	7 (23)	20 (33)
6	$0.86 \leq s < 0.75$	Slightly amb.-averse	5 (19)	3 (10)	8 (14)	9 (30)	13 (44)	22 (37)
7	$0.75 \leq s < 0.66$	Amb.-averse	6 (22)	1 (3.5)	7 (13)	3 (10)	1 (3)	4 (7)
8	$0.66 \leq s < 0.43$	Very amb.-averse	3 (11)	4 (14)	7 (13)	2 (7)		2 (3)
9	$0.43 \leq s < 0.30$	Highly amb.-averse						
10	$s \geq 0.30$	Extremely amb.-averse	2 (7)	1 (3.5)	3 (5)			
Proportion of ambiguity-averse subjects ($s < 1$)			16 (59)	9 (31)	25 (45)	14 (47)	14 (47)	28 (47)

A value of the ambiguity aversion parameter equal to 1 indicates ambiguity neutrality; higher values indicate ambiguity-loving, and lower values indicate ambiguity aversion.