Journal of Economic Behavior & Organization 70 (2009) 470–484

Contents lists available at ScienceDirect

Journal of Economic Behavior & Organization

journal homepage: www.elsevier.com/locate/econbase

Group and individual risk preferences: A lottery-choice experiment with self-employed and salaried workers

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ARTICLE INFO

Article history:
Received 14 April 2007
Received in revised form 30 October 2007
Accepted 28 November 2007
Available online 22 January 2009

JEL classification:
C91
C92
C93
D81
D70

Keywords:
Decision under risk
Individual decision
Group decision
Self-employment

ABSTRACT

This paper focuses on decision making under risk, comparing group and individual risk preferences in a lottery-choice experiment. In the *individual* treatment, subjects make choices individually; in the *group* treatment, each subject placed in a group made lottery choice via voting. In the *choice* treatment, subjects choose whether to be on their own or in a group. The originality of this research lies in the fact that we introduced variability in socio-demographic characteristics by recruiting salaried and self-employed workers. Our main findings indicate that groups are more likely than individuals to choose safe lotteries. Our results also show that individuals risk attitude is correlated with both the type and the sector of employment.

1. Introduction

In many real life situations, important decisions are made by (small) groups such as production units, boards of directors, committees rather than by a single individual. This then raises the question of how the preferences of different group members are combined to produce the group decision. In spite of the fact that many important decisions are made collectively, economics has devoted little empirical attention to group decision-making. In this paper, we contribute to this literature by comparing group and individual decision-making. More precisely, we focus on decision-making under risk and compare group and individual risk preferences in a lottery-choice experiment inspired by Holt and Laury (2002). In this seminal paper, Holt and Laury used the results of a simple lottery choice experiment to determine the degree of risk aversion. Subjects were successively confronted with the following treatments: a real lottery with low payments (less than four Euros in both outcomes), a hypothetical lottery with high payments (the low payment outcomes multiplied by 20, 50 or 90), a real lottery with the same high payments, followed by the same real lottery with low payments as at the start of the sequence.

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doi:10.1016/j.jebo.2007.11.002

Holt and Laury's most important results are that subjects exhibit risk aversion even for low payments and that risk aversion increases sharply as the scale of payoff increases (for real payoffs only).

In our experiment, the risk preferences of groups and individuals are compared by implementing three treatments over eight independent sessions. In the individual treatment (Ind), subjects were asked to choose between playing two lotteries, one "safe" and one "risky", with varying probabilities of obtaining the higher monetary payoff. In the group treatment (Group), each individual was placed in an anonymous group of three and voted over which lottery was chosen. If no unanimous decision was reached in the vote, players were informed of other group members' choices in the current vote, and then voted again. The voting rounds continued until agreement was reached or until five rounds were completed. If five rounds were completed without agreement, then the lottery option was randomly chosen by the computer. Finally, in a third treatment, called the choice treatment (Choice), subjects were asked to state a maximum willingness to pay for making their decisions alone instead of choosing in the group of three people (and thus express their preference over the first two treatments).

The originality of our research lies in the fact that we introduced variability in socio-demographic characteristics by recruiting "real people", including not only students who are typically viewed as the standard subject pool used by experimenters, but also self-employed workers and salaried workers. Indeed, student samples exhibit limited variability in some key characteristics such as age or occupation that may be highly correlated with risk attitude. However, as Harrison and List (2004, p. 1009) noted, these last years, "more and more experimentalists are recruiting subjects in the field rather than in the classroom."[1] Introducing variability in sociodemographic characteristics among subjects allows us to investigate whether contextual effects are robust to the introduction of sociodemographic variables. In addition, it allows us to compare the relative influence of contextual (individual versus group decisions, prior experience, simultaneous versus sequential context) and non-contextual variables (sociodemographic variables) on risk decision. Are individuals more likely to be influenced in their decision by the context or by their intrinsic individual characteristics?

Moreover, do sociodemographic characteristics interact with these contextual variables? Our experiment seeks to provide a first experimental evidence of the link between risk attitude and employment status. In fact, several theoretical research studies emphasize the importance of unobservable factors such as attitudes toward risk and preferences for autonomy in the decision between self-employment and working for others. Partly drawing on Knight's (1921) classic work, Kihlstrom and Laffont (1979) and Rees and Shah (1986) posit that less risk adverse individuals are more likely to choose self-employment. In addition, models by Rees and Shah (1986) and Blanchflower and Oswald (1998) examine other aspects of self-employment such as "the flexibility associated with hours worked and the independence entailed," and "the non pecuniary utility from being independent and one's own boss" (Blanchflower and Oswald, 1998, p. 31). However, there exists very little empirical evidence on the importance of these characteristics in the self-employment decision. In particular, we do not know whether attitudes toward risk or preferences for autonomy play a major role or only a minor role relative to those of human and social environment. In a recent study, using data on Finns born in 1966, Ekelund et al. (2005) found that risk-seekers are significantly more likely to choose self-employment. However in contrast to this paper, in our study, the direction of causality is from self-employment to risk attitude.

The main findings of our study are, consistent with previous work, that groups exhibit more risk aversion than individuals for high-risk lotteries. In addition, our results indicate a further explanation for group decision-making by showing that relative risk-loving subjects (those who are less risk-averse than the other two group members) are more willing to change their vote to conform to the group average risk decision than were relatively risk-averse players. Finally, apart from the context, our results show that a large part of risk attitude is explained by socio-demographic characteristics. In particular, individuals' risk attitude seems to be strongly correlated with both the type and the sector (private or public) of employment. Those who are self-employed tend to be significantly less risk averse than others. In addition salaried workers employed in the private sector tend to take significantly more risk than salaried workers from the public sector.

The remainder of this paper is organized as follows. Section 2 summarizes the relevant previous research comparing groups and individuals. Our experimental design is presented in more detail in Section 3, and Section 4 presents and interprets the results of the experiment. Finally Section 5 summarizes and concludes.

2. Previous literature

A number of empirical results based on natural data concerning team versus individual decisions can be found in the existing literature (financial decisions in Prather and Middleton, 2002, productivity in Hamilton et al., 2003, and betting in Adams and Ferreira, 2007), but the majority of results have come from experimental economics. A recent, growing experimental literature has explored differences between individuals and teams (or between teams of different size) with respect to many different kinds of decisions: beauty-contest games (Kocher and Sutter, 2005; Kocher et al., 2006; Sutter, 2005),

[1] For example, Smith et al. (1988) conducted a large series of experiments not only with student subjects but also with professional and business people from the Tucson community as subjects. Another example are the experiments of Cummings et al. (1995), who used individuals recruited from churches in order to obtain a wider range of demographic characteristics than one would obtain in the standard college setting. Blondel et al. (2007) compared risk aversion and time preference of drug users and non-drug users in order to identify some differences.

centipede games (Bornstein et al., 2004), ultimatum games (Bornstein and Yaniv, 1998), dictator games (Cason and Mui, 1997), signaling games (Cooper and Kagel, 2005), policy decisions (Blinder and Morgan, 2005), location and pricing (Barreda et al., 2002), and auctions (Cox and Hayne, 2006; Sutter et al., 2008). Experimental results on the type of choice that interests us here, risky decisions, can be found in Bone (1998), Bone et al. (1999, 2004), Shupp and Williams (2008), Baker et al. (2008), Bateman and Munro (2005), Rockenbach et al. (2007), and Harrison et al. (2007). The main issues considered in this literature are whether teams make better decisions and whether they are more rational than individuals. No consensus has been reached regarding either question, with results depending on the kind of game under consideration. This conclusion is similar to that reached in social psychology regarding differences in group and individual decisions. In their meta-analysis of replies to Choice Dilemma Questionnaires, Kerr et al. (1996, p. 693) stress that group discussion can "attenuate, amplify, or reproduce the judgment biases of individuals depending on the group decision making process". Rockenbach et al. carried out an experiment where individuals and groups (not consisting of the same subjects) make lottery choices and evaluations. The common effects observed in the literature regarding expected utility theory (the common ratio and preference reversal effects) are found for both individuals and groups (as in Bone et al., 1999). However, teams accumulated significantly more expected value than did individuals, and at significantly lower total risk. In an experiment comparing the risk preferences of two real spouses, both separately and together, Bateman and Munro replicated the result of equal rationality in group and individual decisions mentioned above, but found that joint choices are more risk averse than those made by individuals. Shupp and Williams evaluate risk aversion via certainty equivalent ratios (certainty equivalent/expected value) elicited using a maximum willingness to pay mechanism for lotteries. They find that groups exhibit lower risk aversion than individuals for lotteries with high winning probabilities, but are increasingly risk-averse as winning probabilities fall. Comparing the decisions of the same subjects both alone and in groups, Shupp and Williams stress that group discussion led to greater risk-aversion for lotteries with low winning probabilities. Using Holt and Laury's method (with payoffs raised by a factor of 10), Baker et al. observe the same phenomena as Shupp and Williams. Last, in a paper on preferences over social risk, Harrison et al. also appeal to the same method (with payoffs raised by a factor of 25) and conclude that there are no differences in risk aversion between individuals and groups (consisting of the same subjects). However the general conclusion of this literature on risky decisions with few exceptions (Harrison et al.) is that groups tend to be more cautious than individuals.

Many of the above experiments consider the individual and group treatments independently (i.e. the same individual participates in only one of the two treatments). As such, we cannot examine the behavior of the same individual in two different decision environments. However, if the same subject participates in both treatments, a new problem arises: the order of the treatments. Shupp and Williams include the same subjects in two treatments but do not control for order effects. Baker et al. use an individual-group-individual sequence of decisions and find that subjects were more risk-averse (for high-risk lotteries) in groups than in the first individual treatment and that the group treatment significantly affected the decision in the second individual treatment: individuals exhibited greater risk-aversion than in first individual treatment.

A second point is that the great majority of group decisions in this experimental literature are based on informal discussion (cheap talk) so that the decision-making process within the group cannot be analyzed. It would be very interesting to open the "black-box" to discriminate between the many hypotheses regarding how groups make decisions. The data in Rockenbach et al. are consistent with an excess-risk vetoing rule. In a signaling game experiment, Cooper and Kagel introduced discussion between the two (anonymous) team members via an instant messaging system that recorded discussions. Their analysis of the dialogue between team members leads them to conclude that teams exhibit strong positive cross-game learning whereas individuals show negative cross-game learning, which is consistent with adaptive learning models with a growing number of sophisticated learners.

Compared to the existing literature, we analyze differences in risk aversion between individual and group (three-member) treatments, composed of the same subjects. We take the order effect between these two treatments into account and look into the "black-box" of the group to analyze the decision process leading to unanimous choices. Last, we propose a new approach to the analysis of the taste for autonomy.[2]

3. The experimental design

The experimental procedure is based on that of Holt and Laury. The experiment was computerized and the scripts were programmed using the z-tree platform (Fischbacher, 2007). We recruited 144 subjects among students, salaried workers and self-employed workers. Roughly 43% of our participants were salaried workers or self-employed. The remaining subjects were students who constituted our benchmark population in the experience. The students were recruited from undergraduate courses in business, literature and economics at the University of Rennes (France). None of the subjects had participated in an economics experiment previously. The salaried workers were recruited by phone or by email from public and private

[2] Kocher et al. (2006) appears to be the first contribution considering the taste for autonomy in decision-making. Before individual or group decisions, Kocher et al. (2006) asked individuals to choose between the two decision procedures and to explain their choice. In their experimental beauty-contest game, about 60% of subjects preferred to act in teams (and teams won significantly more often than did individuals). Their analysis of the causes and consequences of self-selection showed that both individuals and team members were satisfied with their chosen role, but for different reasons.

Table 1
Standard payoff matrix.

Decision	Option A				Option B			
	Prob. p	Payoff	Prob. $(1-p)$	Payoff	Prob. p	Payoff	Prob. $(1-p)$	Payoff
1	10%	40 euros	90%	32 euros	10%	77 euros	90%	2 euros
2	20%	40 euros	80%	32 euros	20%	77 euros	80%	2 euros
3	30%	40 euros	70%	32 euros	30%	77 euros	70%	2 euros
4	40%	40 euros	60%	32 euros	40%	77 euros	60%	2 euros
5	50%	40 euros	50%	32 euros	50%	77 euros	50%	2 euros
6	60%	40 euros	40%	32 euros	60%	77 euros	40%	2 euros
7	70%	40 euros	30%	32 euros	70%	77 euros	30%	2 euros
8	80%	40 euros	20%	32 euros	80%	77 euros	20%	2 euros
9	90%	40 euros	10%	32 euros	90%	77 euros	10%	2 euros
10	100%	40 euros	0%	32 euros	100%	77 euros	0%	2 euros

sectors. Finally, self-employed workers were recruited among self-employed farmer, artisan, shopkeeper and professional workers with the help of the Chamber of Commerce of Rennes.[3]

Our overall design consists of eight sessions (with 18 subjects each) of a lottery choice experiment with three treatments. Our first treatment, called the "individual treatment", is based on 10 sequential choices between two lotteries, one "risky" (with payoffs of €77 and €2) and one "safe" (with payoffs of €40 and €32), with probabilities ranging from 10% to 100% (see Table 1). As noted by Holt and Laury, the payoffs for the safe lottery (Option A) are less variable than those for the risky lottery (Option B). In both options the probabilities for the first of the 10 sequential decisions are 10% for the high payoff and 90% for the low payoff. The difference in the expected payoffs between the two lotteries is such that only an extreme risk-seeker would choose Option B. As the probability of the high payoff outcome increases B becomes more attractive relative to A, and at some point subjects will switch their preference. Towards the end of the decision sequence, even the most risk averse subjects should switch over to option B. Contrary to Holt and Laury, the ten decisions were not presented simultaneously, as in Table 1, but shown sequentially and randomly. The "individual" (sequential) treatment consists of 10 successive periods, with a different decision each period. This procedure allows us to measure the differences between group and individual decision-making for each of the ten individual decisions. To test whether introducing sequential framing may affect decisions, we also had a variant of the individual treatment with a simultaneous framing, labeled "simultaneous individual treatment". This treatment is identical to the simultaneous high payoff treatment presented in Holt and Laury.

In the "group" treatment, subjects were placed in anonymous groups of three and presented with the same 10 decisions as in the individual treatment. After each period, the groups were randomly reshuffled. Group members voted over lotteries to try to reach a unanimous decision. If a unanimous decision was not reached, players continued to another vote after being informed of the votes of the other group members. Voting continued until unanimous agreement was reached or until five voting rounds were completed. If no agreement was reached after five votes, the option was randomly chosen by the computer.

The "choice" treatment consists of two stages within each period. In the first stage, each individual is endowed with 10 units (with 2 units corresponding to 1 euro) and is asked how much she would be prepared to pay to make her lottery choice alone, with the proviso that only the three individuals with the highest bids (among the 18 players of the session) will be allowed to play the individual treatment while the others play the group treatment. The price paid by each winner corresponded to the fourth highest bid. In the second stage, subjects were asked to choose between options A and B, alone or by group, depending on the outcome of the previous stage.

In sessions 1–4, subjects initially undertook the individual treatment, followed by the Group treatment and the Choice Treatment. To account for potential order effects, as noted by Harrison et al., we ran two additional sessions (sessions 5 and 6) with a different sample of subjects that began with the group treatment followed by the individual treatment. Finally, we ran two additional sessions (sessions 7 and 8) to test whether presenting the 10 decisions sequentially instead of simultaneously induces a potential "framing effect". In sessions 7–8, subjects initially played the 10 decisions of the simultaneous individual treatment, followed by the sequential individual treatment.

At the end of the experiment, the outcome of each treatment was determined by the random selection of a single decision for each treatment. To control for wealth effects, subjects were informed that only one of the two treatment payoffs would be chosen for the payment at the end of the experiment. On average, a session lasted for about an hour and 20 min, including the initial instructions and payment of subjects. Each participant earned €45 on average plus a lump sum of €3.

[3] Salaried workers were recruited via posters, by phone, and among parents of students to take part in an experiment in economics. Recruitment of self-employed workers involved contacting the Chamber of Commerce of Rennes and the "Club des créateurs et repreneurs d'entreprise d'Ille et Vilaine", an economic club of entrepreneurs sponsored by the Chamber of Commerce, who helped us in contacting potential participants by emails. All participants were recruited "topic blind". Hence participants did not know that the focus of the experiment would be on risk attitude. Experiments were conducted in the same way with students and non-students. Finally there were no differences in payoffs and fees between participants.

Table 2
Risk aversion classification based on lottery choices.

Number of safe choices	Range of relative risk aversion $U(x) = (x^{1-r}/(1-r))$	Risk preference classification	Proportion of choice		
			Indiv treat (1)	Group treat (2)	Choice treat (3)
0–1	$r < -0.95$	Highly risk loving	0.93	–	–
2	$-0.95 < r < -0.49$	Very risk loving	0.93	–	–
3	$-0.49 < r < -0{,}15$	Risk loving	0.93	0.68	–
4	$-0.15 < r < 0.15$	Risk neutral	10.19	0.87	–
5	$0.15 < r < 0.41$	Slightly risk averse	10.19	4.36	4.17
6	$0.41 < r < 0.68$	Risk averse	24.07	31.30	13.89
7	$0.68 < r < 0.97$	Very risk averse	25.93	36.82	45.83
8	$0.97 < r < 1.37$	Highly risk averse	7.41	18.22	27.78
9–10	$1.37 < r$	Stay in bed	19.45	7.75	8.33

4. The experimental results

4.1. Individual and group decisions

Table 2 provides interesting information on the lottery choice frequencies for all treatments. Consistent with Holt and Laury's results, it indicates that in all treatments, most of players are risk averse and choose on average more than four safe options. Table 2 also indicates differences between treatments. The proportion of safe choice is higher in the group and choice treatments than in the individual treatment. For example 36.8% and 45.8% of subjects chose seven safe options, respectively in the group and choice treatments, while this proportion was only of 25.9% in the individual treatment.

Fig. 1a shows the proportion of A choices in sessions 1–4 for each of the 10 decisions listed in Table 1. Fig. 1b displays the corresponding data for sessions 5–6. The horizontal axis represents the decision number, which corresponds to the probability of the higher payoff. The dashed line shows predicted behavior under risk neutrality: A is chosen for the first four decisions, and subsequently B.

In Fig. 1a and b, the percentage choosing the safe option A falls as the probability of the higher payoff increases. The average numbers of "safe" choices (option A) for the individual treatments are 6.6 and 6.5, respectively, for sessions 1–4 and 5–6. Further, groups tend to report higher levels of risk aversion for most of the decisions, except for lotteries with high probability of the larger payoff where groups are actually less likely to choose the safe lottery A. This is consistent with the result of Baker et al. (2008). The average numbers of "safe" choices for the group treatment are 7.11 and 7.03, in sessions 1–4 and 5–6, respectively. A Mann–Whitney test on the total number of "safe" lottery choices over the first 10 periods rejects the null hypothesis of equal means between the individual and group treatments ($z = -1.892$; $p = 0.058$). A similar test over periods 11–20 produces similar results ($z = -1.864$; $p = 0.0623$). These results indicate that groups are more likely than individuals to choose safe lotteries for decisions with low winning percentages. The average number of safe choices is 7.2 in the Choice treatment.[4] A Wilcoxon matched-pairs signed-rank test for differences between the number of safe choices in the group and choice treatments finds no significant difference ($z = -1.628$). Finally, a Wilcoxon rank-sum test cannot reject the null hypothesis of equal distributions between the two individual treatments ($z = 0.120$) as well as between the two group treatments ($z = 0.363$), which shows that "prior experience" has no significant effect.

Fig. 1c shows the proportion of A choices in sessions 7–8 for the simultaneous and sequential individual treatments. It indicates that both the simultaneous and sequential individual treatment show the same patterns: the percentage choosing the option A falls as the probability of the higher payoff increases. The average numbers of "safe" choices are 6.5 and 6.6, respectively for the simultaneous and the sequential individual treatments. A Mann–Whitney test on the total number of "safe" lottery choices over the ten decisions accepts the null hypothesis of equal means between these two treatments ($p > 0.1$).[5]

Table 3 provides a more formal support for these results. It shows the results of a random effect probit model, using "safe choice" (lottery A) as the dependent variable.[6,7] The right-hand side variables include the probability of winning the larger amount (0.1–1.0) and dummy variables for group treatment, choice treatment, prior experience and framing effect. We also included an interaction variable "Group*prob" between the group variable and the winning probability and an interaction variable called "choice*win the auction" between the choice variable and the fact of winning the auction in the choice treatment.

[4] The average number of safe choices under the choice treatment is 6.9 for individuals who decided alone.

[5] One difference between the simultaneous and sequential individual treatments is the higher proportion of subjects switching back from B to A more than once. However in both treatments, this proportion is rather low.

[6] The variable "safe choice" takes the value 1 if the lottery A is chosen for a given decision and zero otherwise. In all estimates, except estimate (6), this variable is not corrected for inconsistent choices (i.e. multiple switches). In contrast, in estimate (6), we corrected for inconsistent choices by considering the first switch only in the analysis. Finally, we also ran additional estimates excluding multiple switchers (available on request). Both estimates provide results similar to those obtained without correction.

[7] In all estimates except estimate (5), the variable "safe choice" corresponds to the group's final response in the group treatment. In estimate (5) this variable indicates the group's initial responses instead of the group's final responses.

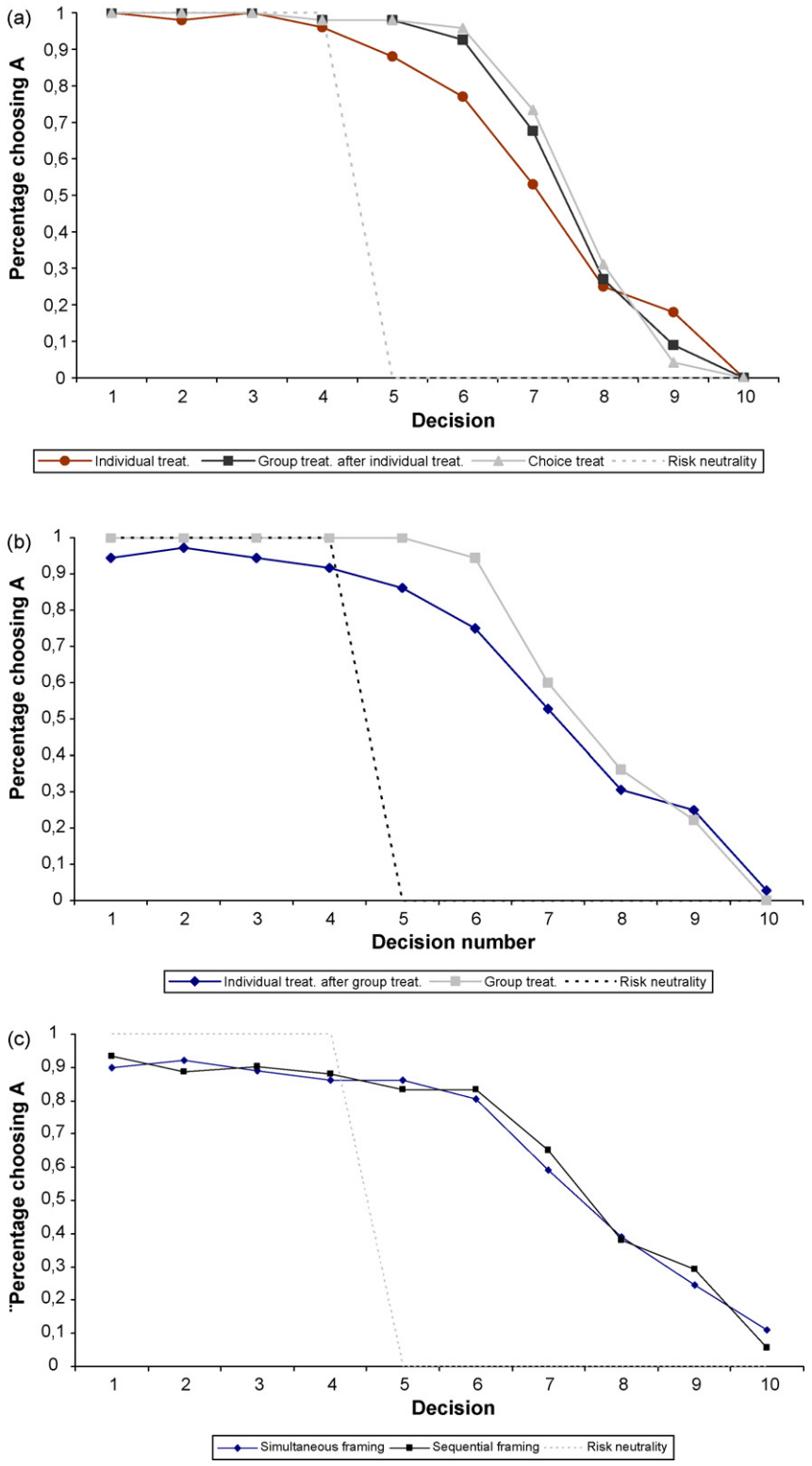

Fig. 1. (a) The proportion of safe choices in each decision (sessions 1–4). (b) The proportion of safe choices in each decision (sessions 5–6). (c) The proportion of safe choices in each decision (sessions 7–8).

Table 3
The probability of safe choice: random effects probit: contextual variables.

	Indiv. and group treatments (sessions 1–6)						Ind, group and choice treatments (sessions 1–6)		Ind treatments sessions 7–8
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
p (higherpayoff)	−0.069***	−.0904***	−0.074***	−0.062***	−0.057***	−0.090***	−0.079***	−0.079***	−0.045***
	(0.0036)	(0.008)	(0.003)	(0.003)	(0.0023)	(0.005)	(0.003)	(0.003)	(0.0033)
Group	0.363***	0.651***	0.432***	5.204***	−0.028	6.440***	0.476***	0.466***	
	(.0111)	(0.186)	(0.095)	(0.644)	(0.082)	(0.851)	(0.087)	(0.097)	
Prior exper.			−.0108	−0.002	−0.093	−0.034			
			(0.192)	(0.212)	(0.176)	(0.278)			
Interaction:				−0.064***		−0.080***			
Group × prob				(0.008)		(0.011)			
Choice treat.								0.166	
								(0.127)	
Choice × win auct								0.308	
								(0.255)	
Simul Fram.									−0.0022
									(0.133)
Constant	4.904***	6.169***	5.229***	4.377***	4.092***	6.431***	5.622***	5.605***	3.203***
	(0.270)	(0.578)	(0.259)	(0.269)	(0.194)	(0.445)	(0.238)	(0.239)	(0.292)
Numb of ind	72	36	108	108	108	108	108	108	36
Numb of obs	1440	720	2160	2160	2160	2160	2790	2790	720
Log-Like.	−362.58	−167.07	−539.05	−496.72	−669.95	−401.26	−648.62	−645.40	−265.23
Sigma_u	0.536	1.406	0.8159	0.894	0.786	1.338	0.822	0.825	1.014
	(0.088)	(0.208)	(0.082)	(0.091)	(0.076)	(0.128)	(0.081)	(0.08)	(0.108)
Rho	0.223	0.664	0.399	0.444	0.382	0.641	0.403	0.405	0.507
	(0.223)	(0.066)	(0.048)	(0.050)	(0.045)	(0.044)	(0.047)	(0.047)	(0.053)

Standard errors in parentheses.
*** Significant at 1% 0.405.

Columns (1) to (4) reveal that the probability of safe choice falls as the probability of the higher payoff increases, and increases when decisions are collective, suggesting the importance of decisions made in a group and underlining the importance of context.[8] The "prior experience" variable is not significant, which confirms our previous results. Finally, the estimated coefficient on the interaction variable "Group*prob" shows that groups become progressively more risk-averse as the probability of the higher payoff falls. Column (6) indicates that similar results are obtained when one considers only the first risky switch in the analysis. Similar results were also obtained excluding multiple switchers (available on request). Columns (7) and (8) show similar results when including the choice treatment in the analysis. Controlling for selection treatment in estimate (8) indicates that selection has no significant effect. Finally, estimate (9) shows that presenting the 10 decisions sequentially instead of simultaneously does not induce any significant framing effect. In the next sub-section, we investigate whether such context effects are robust to the introduction of demographic variables.

4.2. The role of demographic variables in risk decisions

Are previous results affected by the introduction of socio-demographic variables in the analysis? Moreover does risk strongly vary across individuals? Our results indicate a strong heterogeneity among individuals. We observed that the self-employed tend to report a lower level of risk aversion than other populations for most of the decisions. The average numbers of safe choices for the individual treatment are 5.5, 6.7, and 6.6, respectively for self-employed workers, salaried workers, and students. A Wilcoxon rank-sum indicates that the self-employed significantly choose less safe lottery than students ($p < 0.05$). A similar test also indicate that self-employed take more risk than salaried workers ($p < 0.1$). Finally this test indicates no differences between salaried workers and students ($p > 0.1$). This result confirms other empirical analysis (Ekelund et al.).

A detailed analysis of the data also reports differences among salaried workers depending on the choice of the sector (public or private) of employment. Private sector workers report on average 6 safe choices against 7.4 for the public sector employees. A Wilcoxon rank-sum test rejects the null hypothesis of equal distributions between public and private sector employees ($p < 0.1$).

In summary, these results indicate that both the type and the sector of employment are significant determinants of choosing the safer option. To check, we estimated a probit model in Table 4, which yields a measure of the effect of each socio-demographic variable on the probability of choosing a safe option. Indeed it might also be possible that differences among salaried workers, self-employed workers, and students reflect in fact other demographic differences such as gender, age, occupation or education differences.

The estimates include several standard demographics (age, gender, marital statute, education) and some dummy variables to control for the type and the sector (public private) of employment.

Table 4 shows that standard demographic variables have no significant effect on the probability of choosing the safe option. In contrast, variables concerning the choice of type (self/paid) and sector (public/private) of employment significantly affect the decision of choosing the safe option. Both estimate (1) and (2) indicate that self-employed workers tend to be less risk averse than others.[9] In estimate (3), the coefficient associated with the variable «self-employed» is also negative and significant (as opposed to being a salaried worker, which is the omitted category). Turning next to salaried workers, estimate (4) shows that public sector employees are more likely than private sector employees to choose less risk options. Last, estimate (5), (6), and (7) indicate that introducing demographic variables does not change the influence of contextual variable.

4.3. Voting decisions and the determinants of collective choice

We now focus on voting decisions in the group treatment. The vote procedure consists of five rounds of voting. If no unanimous decision was reached during a vote, players went on to the next round of voting after being informed of choices of the other group members in the previous vote. The rounds continued until agreement was reached or until five rounds had been completed. If five votes were completed without agreement, then an option was randomly chosen by the computer. We first consider the evolution of disagreements within groups. Disagreement occurs when the group makes decisions unanimously and when some group member deviates from the average decision. A number of configurations are possible. First, the subject who disagrees is more risk-loving than the other group members and chooses lottery B while the other two group members choose lottery A. Second, the subject is more risk-averse if he chooses lottery A and the other two subjects choose lottery B. There are also two intermediate situations: the subject is weakly more risk averse if he chooses lottery A (or weakly more risk-loving if he chooses lottery B) and one of the two other group members chooses lottery B (lottery A). We then analyze the determinants of collective choice. Fig. 2a and b display the evolution of disagreements within groups in each round of voting and for each of the ten decisions listed in Table 1, for sessions 1–4 and 5–6.

[8] Estimate (5) indicates no significant differences between the individual responses and initial responses in the group treatment. This additional result compared to previous results using final decisions indicates that collective negotiation needs several iterations to converge to a less risky decision.

[9] We acknowledge that such variables should be interpreted cautiously because of a potential endogeneity problem. Indeed, one alternative interpretation of this result is that risk-seeking types would tend to choose self-employment with the implication that self-employment would be endogenous in the choice model.

Table 4
The probability of safe choice: random effects probit: non-contextual variable.

	Individual treatment (sessions 1–8)				Indiv. and group treatments (sessions 1–6)	Indiv., group and choice treatments (sessions 1–6)	All sessions and all treatments
	All indiv	All indiv	Salaried and SE only	Salaried workers only	All indiv	All indiv	All indiv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Socio-demographic variables							
Men	−0.134	−0.134	−0.262	−0.1073	−0.127	−0.184	−0.201
	(0.190)	(0.190)	(0.211)	(0.245)	(0.197)	(0.205)	(0.229)
Age in years	−0.002	−0.002	−.0042	−.0196*	0.006	0.001	0.002
	(0.008)	(0.011)	(0.009)	(0.011)	(0.015)	(0.014)	(0.009)
Married/couple	−0.208	−0.209	−0.1718	−0.1663	−0.287	−0.311	−0.217
	(0.381)	(0.388)	(0.407)	(0.828)	(0.414)	(0.355)	(0.353)
Graduate	0.169***	0.169***	0.138**	0.0749	0.158*	0.123	0.174
	(0.065)	(0.066)	(0.059)	(0.077)	(0.092)	(0.077)	(0.035)
Major is literature	−0.156	−0.156			−0.281	−0.351	−0.034
	(0.395)	(0.395)			(0.464)	(0.485)	(0.425)
Major is busi/eco.	0.153	0.153			0.427*	0.317	0.318
	(0.200)	(0.201)			(0.213)	(0.222)	(0.218)
Salaried worker		−0.0034			0.330	0.299	−0.065
		(0.275)			(0.450)	(0.394)	(0.249)
Public sector employ.				0.838***			
				(0.2610)			
Self-employed w.	−0.671**	−0.673*	−0.668**		−0.727*	−0.661**	−0.697*
Contextual variables	(0.338)	(0.383)	(0.299)		(0.382)	(0.310)	(0.369)
p (higher payoff)	−0.056***	−0.056***	−0.0405***	−.0396***	−0.0625***	−0.063***	−0.055***
	(0.002)	(0.002)	(0.0031)	(0.003)	(0.003)	(0.003)	(0.002)
Group					4.153***	4.620***	5.075***
					(0.533)	(0.473)	(0.457)
Prior experience					0.0094	−0.088	−0.0456
					(0.227)	(0.231)	(0.248)
Interaction:					−0.051***	−0.056***	−0.063***
Group × proba.					(0.007)	(0.006)	(0.005)
Constant	3.727***	3.71***	2.861***	3.869***	3.783***	4.207***	3.485***
	(0.394)	(0.399)	(0.474)	(0.702)	(0.492)	(0.425)	(0.430)
Observations	1440	1440	620	480	2160	2880	3600
Number of ind	144	144	62	48	108	108	144
Log-Likelihood	−489.62	−489.62	−255.40	−192.678	−521.05	−635.86	−911.96
Sigma_u	0.913	0.913	0.627	0.577	0.841	0.863	0.957
	(0.094)	(0.094)	(0.110)	(0.124)	(0.087)	(0.087)	(0.084)
Rho	0.455	0.455	0.282	0.249	0.414	0.428	0.478
	(0.051)	(0.051)	(0.0711)	(0.080)	(0.050)	(0.049)	(0.043)

Standard errors in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

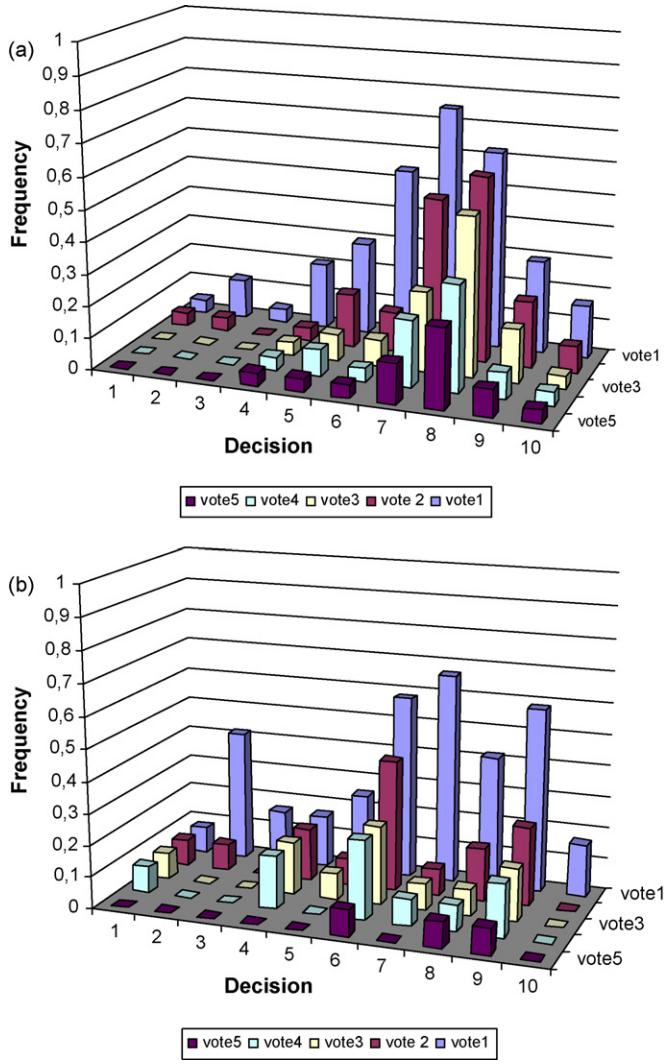

Fig. 2. (a) Frequency of disagreements for each decision in treatment 4 (sessions 1–4). (b) Frequency of disagreements for each decision in treatment 4 (sessions 5–6).

As expected, unanimous group decisions were more difficult for the intermediate probabilities (decisions 5–8). The figures also show that the probability of disagreement decreases with the number of voting rounds. For example, the probability of disagreement is 75% in vote 1 of decision 7 in sessions 1–4 and decreases to 12% in vote 5. Groups therefore required several rounds of voting to reach unanimous decisions. Most unanimous decisions involved the safe lottery (A), and the average number of A lotteries chosen increases with the number of votes. For example, the probability of choosing lottery A increases from 66% in vote 1 in sessions 1–4 (63% in sessions 5–6) to 70% (71%) in vote 5. This result is of interest because it suggests that decision-making under the unanimity rule produces safer choices.

One possible reason for this result might be that risk lover players would be less reluctant than others to converge to a safer choice. To investigate in more detail this possibility, we considered to what extent relative risk lovers were less reluctant than others to change their vote by considering the relationship between the probability of changing a vote between two rounds of voting and the individuals' risk attitude relative to the group's average risk attitude. The groups defined on the horizontal axis are determined as described above.

Fig. 3 shows that the probability of changing a decision between two rounds of voting depends on the relative risk attitude compared to the rest of the group. The probability of changing a decision is greater when the two other group members have voted for the same lottery. Fig. 3 also shows that relative risk lovers are more likely to move to a less risky choice than are the relatively risk-averse to move to a more risky choice.

Table 5 provides a formal support of this result via a random effects probit on the probability of changing a decision between two votes. The key independent variable is "relative risk lover", which equals one if the subject chose the risky option while at least one of the other group members chose the safer lottery. The coefficient on this variable is interpreted

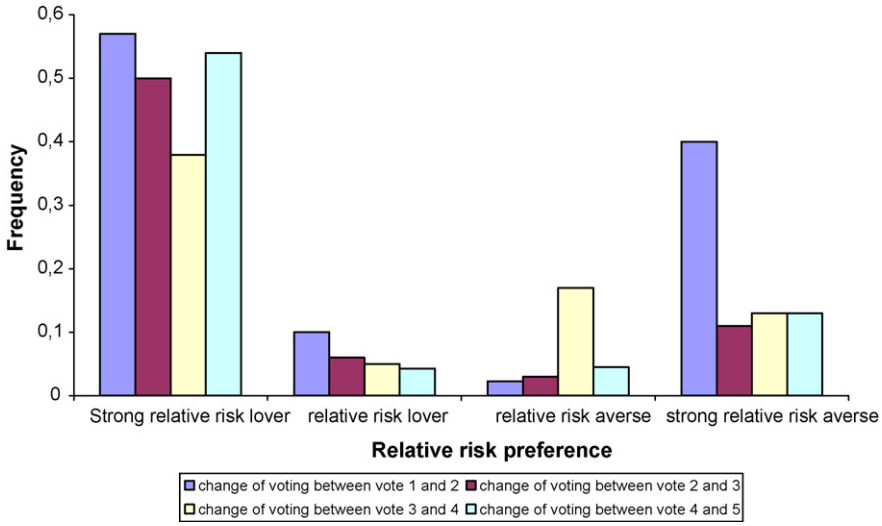

Fig. 3. Change of vote decision as a function of relative risk aversion.

Table 5
Changing lottery decision between two votes: random effects probit.

	(1)	(2)
Relative risk lover	1.0766***	1.031***
	(0.2925)	(0.295)
Men		−.0981
		(0.141)
Age in years		0.0112
		(0.007)
Married/couple		.0693
		(.241)
Graduate		−0.0724
		(0.052)
Self-employed		0.0402
		(0.225)
Constant	−0.661***	−0.7059***
	(0.089)	(0.218)
Observations	476	476
Log likelihood	−291.00	−289.07
Sigma_u	0.347	0.285
	(0.109)	(0.124)
Rho	0.107	0.075
	(0.060)	(0.06)

Standard errors in parentheses.
*** Significant at 1%.

in relation with the omitted variable "relative risk averse". The second specification includes additional variables to control for demographics.

The results in Table 5 confirm our previous results. The estimated coefficient on "relative risk lover" is positive and significant at the 5% level so that the probability of switching is higher if the subject is more risk loving than other group members. Relative risk lovers change their votes to safer options more often than the relatively risk averse change their vote to riskier options. This result indicates that groups converge toward less risky decisions because subjects who were relatively less risk averse were more likely to change their vote in order to conform to the group average decision.[10]

[10] This result can be related to the existing literature on conformity. Jones (1984) presented an economic theory of conformity where peoples' tendency to conform persists even after an initial "social influence" is removed. Persistence of social conformity is explained by tradition and internalization of social values. Bernheim (1994) also presented a model of conformity, assuming that individuals care about intrinsic utility but also about status. When status is sufficiently important relative to intrinsic utility, some individuals may be willing to conform to a standard behaviour (social norm) because a small departure from this standard may seriously impair their status. Some studies have also investigated the importance of conformity in the context of team production (Kandel and Lazear, 1992; Barron and Gjerde, 1997). These studies show how conformity influences cooperation within teams through peer pressure. Peer pressure refers to a psychological pressure felt by agents when they compare their action with the actions taken by theirs colleagues. Peer pressure leads individuals to conform to social norms. Finally, in a recent study, Levitt and List (2007) investigated the relationship between conformity and

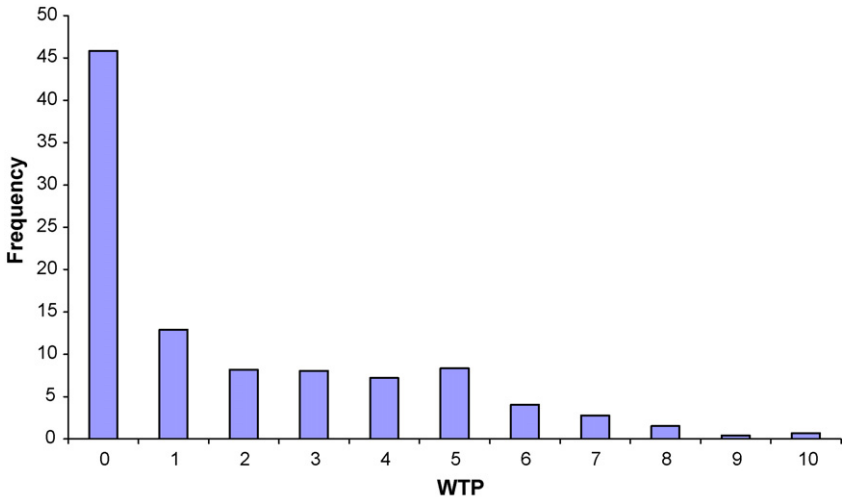

Fig. 4. Frequency of bids.

4.4. Willingness to pay (WTP) and risk aversion

In this section, we consider the determinants of bidding in the first stage of treatment "Choice". Remember that in this treatment, only the three players with the highest bids (among the 18 players of the session) are allowed to play the individual treatment while the others play the group treatment. Fig. 4 presents the frequency of bids in the first stage of the choice treatment.

In 45% of cases subjects chose the minimum bid of 0 units and fewer than 1% chose the maximum bid of 10 units. The average bid is 1.9 units over all participants, with figures of 5.71 units for those who decided individually and 1.14 units for those who decided in groups. Table 6 provides a formal analysis of the determinants of WTP, using a Tobit model to control for censoring. The right-hand side variables include several socio-demographic variables and a variable measuring risk aversion (the number of safe choices under the individual treatment). Finally we also include a variable controlling for previous conflicts within groups by considering whether the lottery was randomly chosen by the computer in the previous period in the case of disagreement.

Table 6 shows that several socio-demographic variables are significant. Both men and older individuals are more likely to propose a higher bid. Interestingly, individuals who are married/in couple would be less likely to propose a higher bid. A possible interpretation of this result is that married/in couple people are more likely than others to take group decisions. Finally, we find a positive and significant coefficient associated with the variable "self-employed worker", indicating that self-employed workers' bids are significantly higher. This result is consistent with the interpretation in term of willingness to decide alone as suggested by Rees and Shah (1986) and Blanchflower and Oswald (1998) who consider "the flexibility associated with hours worked and the nonpecuniary utility from being independent and one's own boss" as strong determinants of self-employment (Blanchflower and Oswald, 1998, p. 31). Last, Table 6 shows that risk aversion is negatively and significantly related to current bids, indicating that less risk averse individuals are more willing to escape from the tyranny of group decision-making, especially since they tend to compromise more frequently in the group treatment.

5. Conclusion and discussion

The main findings of our study are that both context and socio-demographic variables significantly influence the choice of risky options. Our results indicate that age, gender, or marital statute do not significantly influence the probability of choosing the safe option. In contrast, both the type and the sector (private or public) of employment seem to influence risk decisions significantly. Our results show that the self-employed report lower level of risk aversion than other individuals for most of the decisions. In addition, consistent with previous literature, we also observe that public sector employees are generally more likely than private sector employees to choose the safer option (Bellante and Link, 1981). As it is argued by Bozeman and Kingsley (1998), risk avoidance is not necessarily a determinant of job choice but may be a consequence of remuneration schemes. Indeed employees who have low expectation that good performance will be rewarded (in the public

moral concerns. Levitt and List presented a model that assumes that individual choices depend not only on financial implications but also on non-monetary moral costs (or benefits) that may vary across people and that may be also influenced by several factors such as context or scrutiny. In particular, moral concerns may depend on the process by which the decision is reached (negotiation, discussion, vote, etc...).

Table 6
WTP for deciding alone: random effects Tobit regressions.

Socio-demographic variables	
Men	0.473*
	(.281)
Age in years	0.101***
	(0.0101)
Married/couple	−1.762***
	(0.406)
Graduate	−0.0285
	(0.0967)
Self-employed worker	2.587***
	(0.378)
Contextual variables	
Risk aversion	−0.135***
	(0.036)
Random vote in $t-1$	0.495
	(0.368)
Constant	2.587
	(0.3788)
Nb. Obs	720
Nb. Ind.	72
Log likelihood	−1039.03
Left-censored	330
Sigma_u	3.00
	(0.173)
Rho	2.05
	(0.078)

Standard errors in parentheses.
* Significant at 10%.
*** significant at 1%.

sector) may tend to perceive lesser risk taking than employees who have high expectation that good performance will be rewarded (in the private sector).

Turning to the influence of contextual variables, our results indicate that decisions are influenced neither by prior experience nor by the framing of the experience (sequential or simultaneous framing, i.e. the way of presenting the decisions). On the contrary, our data reveal that groups are more likely to choose safe lotteries than are individuals. Introducing socio-demographic variables does not change these effects.

We then provide new insights on group decision-making by showing that relative risk-lovers (subjects who are less risk averse than the other two group members) were more likely to change their position than were relatively risk averse players who were reluctant to change their position. Finally, our results indicate that less risk averse individuals (including self-employed workers) were more likely than others to propose a higher bid to escape from the tyranny of group decision-making.

Our results about the importance of context and socio demographic variables can be interpreted in relation to the recent paper of Levitt and List. In this paper, the authors show that individual choices depend not only on financial concerns but also on the context in which decisions are embedded, the way the participants are selected, and the nature and extent of scrutiny. These dimensions have particular implications for lab experiments that seek to investigate differences across groups.

There are number of possible explanations for the group decision making. We have presented our results in terms of willingness to conform to the group. Alternatively, group decision-making may derive from strategic or non-strategic motives (altruism, fairness). While it is difficult to distinguish cleanly between theories, we note that our experimental design rules out strategic reasons since all participants were rematched after each period. Also social preferences cannot explain why voting rounds differ from one another in probability of disagreement.[11]

Our findings are of interest in the context of previous researches. As discussed in the paper, previous results on the effect of collective decision-making on risky choice are mixed. Harrison et al. find no group effect, while Baker et al. indicate that groups are on average more likely than individuals to choose safe lotteries for low winning probabilities. A possible explanation for these differences is that the rule by which decisions are reached is different. In both our work and that of Baker et al., subjects were asked to make unanimous decisions, inducing less risk-averse subjects to converge toward less risky decisions. On the contrary, in Harrison et al., each group voted for the lottery he preferred under a majority voting rule.

[11] Another alternative explanation of our experimental results is that the background risk of choosing randomly an option if no agreement is obtained after vote 5 might interact with individual risk aversion. However, if this were the case, one should observe a higher level of disagreement in the last voting round compared to the previous rounds. On the contrary, our results indicate that the probability of disagreement decreases over time with the number of voting rounds, which is more consistent with our conjecture of a dynamic conformity to the group.

There are grounds to expect that choices will be different under the unanimity rule than under the majority rule. Indeed it seems reasonable to assume that the unanimity rule induces more pressure toward uniformity in groups than the majority rule. Moreover, the alternatives over which the group decides may also be influenced not only by the decision rule but also by the amount of information individuals have about one another's preferences. These are likely fruitful areas for additional research on group decision-making. Concerning socio-demographic variables, our results can be related to previous research on occupational choice. Indeed some theoretical research showed the importance of unobservable factors such as attitudes toward risk or preferences for autonomy in the occupational choice (Kihlstrom and Laffont, 1979; Rees and Shah, 1986). However, there exists very little empirical evidence on the importance of these characteristics in the employment decision. One reason is that such characteristics are generally unobservable. In this regard, additional experiments may provide new empirical evidence that the value placed on the stability of employment depends to some extent on the individual's degree of risk aversion.

Acknowledgments

We are grateful to Glen Harrison, Jayson Lusk, Claude Montmarquette, the participants at the ESA North American Meeting (Tucson) and the participants at the Risk Attitude Workshop. We are also grateful to two anonymous referees. Thanks to Elven Priour for programming the experiment presented in this paper, to the ANR Risk Attitude (Agence Nationale de la Recherche) for a grant to support this research and to Pierre-Jean Richard from the "Club des créateurs et repreneurs d'entreprise d'Ille et Vilaine" and the Chamber of Commerce of Rennes for help in recruiting self-employed participants.

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