

# Individual vs. couple behavior: an experimental investigation of risk preferences

Mohammed Abdellaoui · Olivier l’Haridon ·  
Corina Paraschiv

Published online: 15 July 2012  
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**Abstract** In this article, we elicit both individuals’ and couples’ preferences assuming prospect theory (PT) as a general theoretical framework for decision under risk. Our experimental method, based on certainty equivalents, allows to infer measurements of utility and probability weighting at the individual level and at the couple level. Our main results are twofold. First, risk attitude for couples is compatible with PT and incorporates deviations from expected utility similar to those found in individual decision making. Second, couples’ attitudes towards risk are found to be consistent with a mix of individual attitudes, women being more influent on couples’ preferences at low probability levels.

**Keywords** Couples · Group decisions · Risk · Uncertainty · Prospect theory · Utility · Gender

## 1 Introduction

Many economic and financial decisions like consumption, saving, investment, or labor supply are made at the family level and often imply the two adult members of the

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M. Abdellaoui  
HEC-Paris & GREGHEC-CNRS, 1 rue de la libération, 78351 Jouy en Josas Cedex, France  
e-mail: abdellaoui@hec.fr

O. l’Haridon (✉)  
Crem-Université de Rennes 1 & GREGHEC, Rennes, France  
e-mail: lharidon@greg-hec.com

C. Paraschiv  
Université Paris Descartes & GREGHEC, Jouy en Josas Cedex, France  
e-mail: paraschiv@hec.fr

family household. These decisions cover a wide range of choices from basic needs to the consumption of durable goods, careers, housing, fertility, investment in children's education, retirement, and health plans. The literature on within-household decisions has been devoted mainly to riskless consumption decisions. However, most of the financial decisions made by couples involve risk. Examples of such decisions include the choice of either a common saving or bank account or a private one, choice of a monthly saving rate and choice of a retirement plan. Recent literature suggests that an understanding of such risky decisions for couples might be of great interest, especially from a behavioral perspective ([Bateman and Munro 2005](#); [Chambers and Echenique 2010](#); [De Palma et al. 2011](#); [Mazzocco 2004](#)). This article aims at investigating this issue and provides an experimental test of the nature of decision making within the couple.

We complete previous studies on couple decision making in several respects. First, we interview couples' members both individually and jointly. The joint interview allows to investigate the behavioral interactions between the couple and its individual members and, in particular, women and men bargaining power in collective decision. Second, we propose a more precise comparison between individuals and couples than in previous studies because we estimate the components of prospect theory (PT). This insight allows us to compare couples and men/women not only in terms of utility but also in terms of probability weighting. We assume that the couple's members are characterized by individual preferences and that the couple acts as a specific decision maker whose preferences could be measured independently of its members' preferences.

The main results are the following: probabilistic risk attitudes of individuals and couples show similar judgement biases and are compatible with an inverse S-shaped probability weighting function. Moreover, couples' probabilistic risk attitude is found to be a mix of the partners' attitudes: it lays within the boundaries of each partners' individual attitude: couples' preferences are closer to the women's preferences at low-probability levels and closer to the men's at high-probability levels.

The remainder of the article is organized as follows. Section [2](#) gives a brief literature review. In Sect. [3](#), we review PT and the associated measurement method. The design and the experiment are described in Sect. [4](#). Results are presented in Sect. [5](#). Section [6](#) concludes the article.

## 2 Related literature

In the usual approach to consumer behavior it is often assumed that households behave as if they were single decision-making units maximizing a well-behaved utility function. It is now well established that this standard representation of preferences fails to provide a satisfactory representation of household preferences. First, a large body of empirical evidence shows that the so-called unitary model of household consumption, based on the assumption of a single set of preferences, is rejected by the data ([Lundberg et al. 1997](#); [Browning and Chiappori 1998](#); [Cherchye et al. 2009](#)). Second, assuming a single preference relation for the household is not consistent with the usual requirements of methodological individualism. As multi-adult households consist of several members, their behavior results from bargaining processes and should be investigated

on the basis of individual preferences through a collective decision model (Chiappori 1988; Browning and Chiappori 1998). The collective approach assumes that each member of the household has specific preferences and that the household behavior results from a bargaining process leading to a Pareto efficient allocation of resources. The bargaining process attaches weights to each member of the household in the intra-household bargaining process. These weights can be interpreted as bargaining power. The utility of the household is then defined as the weighted average of the utilities of its members. In this riskless setting, the weights are endogenous and depend on individual characteristics. Kebede et al. (2011) in a large-scale experiment showed that significant amounts of potential surplus are not realized and efficiency not attain in household decision making. These results cast doubts on both the unitary and the collective model.

With few exceptions (Mazzocco 2004), the literature refers to the unitary model for decisions under risk. There might be, however, significant heterogeneity in individual attitudes towards risk within a couple and joint decisions might emerge from various bargaining processes. Using data from the *German Socio-Economic Panel*, Dohmen et al. (2011) found positive correlation of risk-attitudes within couples. On the basis of data from the *US Health and Retirement Study*, Mazzocco (2004) showed that about 50 % of couples reported that the wife's risk preferences differed from the husband's. Moreover, Mazzocco (2004) found that average savings of couples was a U-shaped function of the husband's risk-aversion. In the experimental economics literature, Bateman and Munro (2005) were the first to design an experimental test for couple decisions under risk. Their results were twofold. First, they showed that couples followed a similar pattern of violations of expected utility when compared to the usual results in individual choice experiments. Munro and Popov (2009) also found that couples exhibit an endowment effect in more or less the same way as the non-couples in a between-subject experiment. Second, Bateman and Munro showed that individual and collective expressions of value for decision under risk were different. Indeed, couples appeared to be more risk-averse when facing tasks together than when the partners faced the same decision making tasks alone. A similar result can also be found in the recent literature on group decision making (Baker et al. 2008; Shupp and Williams 2008 for high-risk situations). On the contrary, Chambers and Echenique (2010) showed that when aggregating individual welfare with certainty equivalents, a couple of risk-averse individuals behave in the aggregate in a fashion that is less risk-averse than its individual members. De Palma et al. (2011) also built an experiment that aimed to establish the relationship between couples' and individuals' behavior toward risk. They paid special attention to the dynamics of the decision process. They found that the balance of power was modified during the bargaining process and that women gained more and more power over the course of the decision-making process as time passed. Carlsson et al. (2009) measured the link between wealth and spouses' similarity in risk attitudes in an experiment performed in rural China. They observed a positive link between household wealth and similarity of partners' preference toward risk. They also found the balance of power to be in favor of men. However, when women contributed relatively more to the household income, couples' risk attitude was more likely to reflect women's preferences.

### 3 Theoretical background and elicitation method

To compare individuals' and couples' preferences under risk and test the difference between them, we use PT (Tversky and Kahneman 1992), currently the most widely used descriptive theory of decision under risk (Starmer 2000; Wakker 2010). In what follows, we first present PT. Then, we present the elicitation method used to estimate individuals' and couples' preferences under risk.

#### 3.1 Decision making under risk and PT

We consider a decision maker, either an individual or a couple, who has to make a choice between two risky prospects. As we only use prospects with at most two distinct outcomes, we restrict the framework to such prospects.  $(x, p; y)$  denotes a prospect that results in outcome  $x$  with probability  $p$  and in outcome  $y$  with probability  $1 - p$ . We assume that  $x \geq y \geq 0$ . Outcomes are monetary amounts and higher numbers are always preferred. If  $x = y$ , the prospect is said to be riskless, otherwise it is said to be risky. Under PT, preferences over prospects are represented by a real-value utility function,  $u(\cdot)$ , defined over monetary outcomes as changes with respect to a reference point, and by a probability weighting function  $w(\cdot)$ . The utility function is strictly increasing from  $\mathbb{R}$  to  $\mathbb{R}$  and satisfies  $u(0) = 0$ . As we consider only gains in this article, then PT corresponds to rank-dependent utility (Quiggin 1982). Also, we take 0 as the reference point.

The decision maker evaluates each prospect separately and chooses the prospect that offers the highest value. The PT valuation of prospect  $(x, p; y)$  is given by

$$w(p)u(x) + (1 - w(p))u(y) \quad (1)$$

Function  $w$  is strictly increasing from  $[0, 1]$  to  $[0, 1]$  and satisfies  $w(0) = 0$  and  $w(1) = 1$ . In Eq. 1,  $w(p)$  and  $1 - w(p)$  are the decision weights attached to the larger and lower outcomes, respectively. Kahneman and Tversky (1979) assumed that the probability weighting function  $w(\cdot)$  overweights small probabilities and underweights moderate and high probabilities, giving rise to an inverse S-shaped function. This assumption has been confirmed by the literature (Tversky and Kahneman 1992; Tversky and Fox 1995; Wu and Gonzalez 1996). Under expected utility, these decision weights are equal to  $p$  and  $1 - p$  and the probability weighting function—if any—corresponds to the identity function. Tversky and Kahneman (1992) assumed that the utility function was concave for gains, which is confirmed by the empirical literature (Tversky and Kahneman 1992; Gonzalez and Wu 1996; Abdellaoui et al. 2007; Booij and van de Kuilen 2009).

#### 3.2 Elicitation method

Our elicitation method of utility under risk is based on Abdellaoui et al. (2008) and consists of two stages. In the first stage, utility is elicited, then, in the second stage, we focus on the elicitation of probability weights. We start by selecting a probability  $p^*$

and a series of  $k$  pairs of outcomes  $\{(x_i, y_i) : i = 1, \dots, k\}$  that are kept fixed throughout the elicitation of the utility function in the gain domain. Next, we elicit  $k$  certainty equivalents  $z_1, \dots, z_k$  for a series of risky prospects  $(x_i, p^*; y_i)$  with  $i = 1, \dots, k$ . The advantage of keeping the probability  $p^*$  fixed is that only one additional parameter,  $\tau = w(p^*)$ , has to be estimated besides the parameter(s) of the utility function. If we adopt a parametric specification for utility, the series of certainty equivalents allows us to estimate  $\tau$  and the utility parameter under PT through nonlinear least squares  $\|z - \hat{z}\|^2$  with

$$\hat{z}_i = u^{-1}[\tau \cdot (u(x_i) - u(y_i)) + u(y_i)] \quad (2)$$

$i = 1, \dots, k$ . Once utility has been determined in the first stage, the decision weights can be elicited in the second stage. To do so, we select an outcome  $x^*$  and a series of  $m$  probability levels  $\{p_j : j = 1, \dots, m\}$  that are kept fixed throughout the elicitation process. Then  $m$  certainty equivalents  $z'_1, \dots, z'_m$  are elicited for a series of risky prospects  $(x^*, p_j; 0)$ ,  $j = 1, \dots, m$ . Under PT and according to Eq. (1), the decision weights associated with a given probability  $p_j$  can be computed as:

$$w(p_j) = \frac{u(z'_j)}{u(x^*)} \quad (3)$$

$$j = 1, \dots, m.$$

## 4 Experiment

### 4.1 Subjects

Subjects were people living in the city of Paris, France. 130 subjects took part in the experiment (65 couples). Each couple was paid €50 for its participation. In addition, we implemented a between-subject random-lottery incentive scheme. Before starting the experiment, participants (individuals and/or couples) were informed that they could be selected to play one of their choices for real and could win a maximum of €1,200 depending on their choices. Together with gender, we also collected information on age, number of children, and the length of the relationship. Couples were recruited through advertisements made in a number of public places in Paris: schools, associations, day-care centers, and social events. A couple was selected to participate in the study only if each of the partners was over the age of 25 and the couple had lived at least 1 year together. The minimum age condition was used to exclude from the study young student couples that were not yet financially independent from their parents. Moreover, 1 year of life in common was requested to insure that the two people had already had the opportunity to take financial decisions together.

The experiment was conducted in the form of computer-based individual interviews. A special software had been developed for the purpose of the experiment. Subjects were told that there were no right or wrong answers, and were allowed to

take a break at any time during the session. The responses were systematically entered in the computer by the interviewer so that the subjects could focus on the choice questions. We always carried out the individual interviews before the couple interview. This design was meant to minimize the potential impact of couples' answers on individuals' answers. For individual interviews, the gender order (female/male or male/female) was random. The structure of the individual and joint session was the same. In the latter, couples were allowed to freely communicate and no time constraint was imposed to the decision-making process. This allowed couples to bargain over the decisions. According to the collective view of the household, the potential gains were proposed to the couple without any predetermined sharing rule. The experiment was part of a larger experiment that lasted on average one hour and a half, including 5–10 min for task explanation and practice questions.<sup>1</sup> The average duration of the experiment for women (15.4 min) was no significantly higher than the duration for the men (12.6 min) but was higher than duration for the couples (11.2 min). The average duration for the couples' may differ from the individuals' for one of two reasons. First, an adaptation effect may have arisen because each of the individuals in the couple had already provided a personal answer to the tasks they were subsequently asked as a couple. This effect might have resulted in reducing the duration of the experiment. Second, a bargaining effect might also exist as couple decisions which are collective decisions with an extensive use of communication (Ashraf 2009). This effect might have increased the duration of the experiment. The lower average duration observed for couples showed that the adaptation effect was higher than the bargaining effect for women only. This is partly consistent with Blinder and Morgan (2005) result which shows that groups are just as quick as individuals to reach decisions.

We discarded one couple from the experiment because the husband did not understand the tasks and gave incomplete answers. This left 128 subjects (64 couples) for the analysis.

#### 4.2 Experimental methods

We used 11 certainty equivalence questions to elicit the utility function and the decision weights. Details are provided in the Appendix. All indifferences were elicited through a three-step iterative choice list procedure. In the first step, subjects had the choice between a fixed prospect and a variable amount of money. The latter was framed as linearly equally spaced outcomes between the minimum and the maximum amounts given in the fixed prospects. The second and third steps refined the choice at the point where subjects had switched in the previous list. Both sides of the switching point served as a bound for the next choice list. We divided the range into 11 categories for each of the steps.

To ensure consistency and incentive compatibility and to control for response error, we added a fourth step to the choice list procedure (Abdellaoui et al. 2011) for a

<sup>1</sup> The second part of the larger experiment consisted in decisions over time whose results are not reported here.

**Table 1** Classification of subjects in terms of risk attitude

	Risk-averse	Risk-seeking	Mixed
Women	27	17	20
Men	25	22	17
Couples	23	24	17

similar procedure). This fourth step corresponded to the entire choice list that would have been generated by refining every possible switching point from the first list. Assuming monotonicity, the computer pre-filled the list based on the answers given during the previous steps. Then the list was presented to the subject for validation. The software allowed backtracking if participants did not wish to validate their previous series of choices. Figure 3 in the Appendix gives an example of the way in which the experimental questions were displayed.

The order in which the six prospects used to elicit utility were presented was randomized. However, we learned from the pilot sessions that the subjects found it easier to deal with an increasing order in probabilities (from  $p = 0.05$  to  $p = 0.95$ ) than with a randomized order. The order in which the five prospects used to elicit decision weights were presented was deterministic and always came after the questions used to determine utility.

## 5 Results

### 5.1 Risk attitudes

Table 6 in the Appendix shows the median responses to all the certainty equivalence questions that we asked during the experiment. Overall, 53 % of the choices made by women, 49 % of the choices made by men, and 48 % of the choices made by couples were consistent with risk-aversion. Women were more risk-averse than men and couples at  $p = 0.019$ .<sup>2</sup> De Palma et al. (2011) found a similar result. In contrast, we found no significant difference between men and couples risk-aversion. This contradicts Bateman and Munro (2005) results for decision making in couple but agrees with the findings by Budescum et al. (2010) in group decision making. To obtain a more precise picture of risk attitudes, we constructed an individual classification of subjects, reported in Table 1. We classified a subject as risk-averse (risk-seeking) if at least two-thirds of certainty equivalents were smaller (higher) than the expected value of the risky prospect. If the participant—individual or couple—was neither classified as risk-averse nor risk-seeking, then he/she/it was classified as mixed.

The proportion of risk-averse women (42.2 %) was higher than the proportion of risk-seeking women ( $p = 0.03$ ). Although a majority of men were classified as risk-averse (39 %), this proportion was not significantly higher than the 34.4 % of risk-seeking men ( $p = 0.29$ ). Among couples, 35.9 % were classified as risk-averse and 37.4 %

<sup>2</sup> The binomial test was used to test for differences between proportions.

as risk-seeking. The difference in proportion was not significant here. Risk-averse couples were composed mainly of risk-averse individuals (9 out of 23) and risk-seeking couples were composed mainly of risk-seeking individuals (8 out of 25). Couples classified as mixed were composed mainly of risk-averse women and risk-seeking men (5 out of 17).

To better account for the relation between couples' and individuals' risk attitudes, we computed individual relative risk premia (risk premium for prospect  $i$  is defined as  $(\text{ev}_i - z_i)/(\text{ev}_i)$ , where  $\text{ev}_i$  denotes the expected value). Risk premia allowed us to measure the strength of risk-aversion (risk-seeking): a higher positive (negative) value of the risk premium indicates a higher level of risk-aversion (risk-seeking). Correlations between men and women risk premia were low and not significant (mean correlation coefficient:  $\bar{\rho} = 0.10$ , absence of significance at 5 % for 10 correlation coefficients over 11). We found neither positive assortative matching: risk-averse (seeking) women are not specifically matched with risk-seeking (averse) men nor negative assortative matching: risk-averse (seeking) women are not specifically matched with risk-averse (seeking) men.<sup>3</sup> By contrast, correlations of risk attitudes between both men and couple and women and couple were high ( $\bar{\rho} = 0.415$  for women,  $\bar{\rho} = 0.56$  for men, all single correlation coefficients significant at 1 %, except one). Men risk attitudes appeared to be more correlated with couples' risk attitude than women risk attitudes. Eliciting PT allows a more structured view of the composition of risk attitudes within the couple: results are given in the next subsection.

Consistent with previous experimental findings in individual decision making under risk (Starmer 2000 for review), risk-aversion varied systematically with the probability used to elicit the certainty equivalents. We found risk-seeking over low-probability gains, and risk-aversion over high-probability gains. These behaviors are characteristic of the fourfold pattern of risk attitude, which was, according to its authors, one of the most distinctive implications of PT (Tversky and Kahneman 1992, p. 306). Figure 1 shows the percentage of risk-averse participants as a function of the probability used in the elicitation.

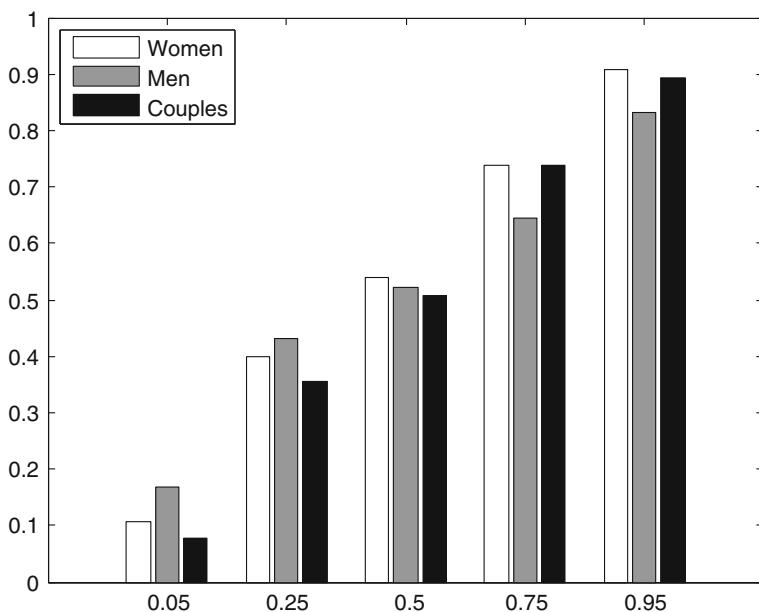
Risk-seeking was clearly dominant for probability  $p = 0.05$  and risk-aversion was dominant for probabilities  $p = 0.75$  and  $p = 0.95$ . For intermediary probabilities  $p = 0.25$  and  $p = 0.50$ , evidence was less clear cut. For probability  $p = 0.25$ , we found risk-seeking for couples ( $p = 0.02$ ) but neither for men ( $p = 0.21$ ) nor for women ( $p = 0.13$ ). For probability  $p = 0.50$ , we found no evidence for risk-aversion.

## 5.2 Prospect theory

### 5.2.1 Utility

We used a power parametric specification for utility:  $u(x) = x^\alpha$ . For gains, the power function is concave if  $\alpha < 1$ , linear if  $\alpha = 1$ , and convex if  $\alpha > 1$ . Table 2 reports the utility estimates for women, men, and couples, together with the number of individuals with a concave or a convex utility function.

<sup>3</sup> Carlsson et al. (2009) found similar results in a rather different context of choice under risk.



**Fig. 1** Risk-aversion (% of risk-averse subjects) as a function of probabilities

**Table 2** Median estimates for utility under risk

	Power ( $\alpha$ )		
	Women	Men	Couples
Median	0.88	0.81	0.96
IQR	0.74–1.36	0.62–1.05	0.83–1.17
#( $\alpha \leq 1$ )	39	46	36
#( $\alpha > 1$ )	25	18	28

For couples, utility was linear: the median power coefficient of 0.96 did not significantly differ from 1 [ $t(63) = 0.33, p = 0.74$ ]. For men, utility was concave: the median power coefficient was equal to 0.81 (Wilcoxon,  $p < 0.01, t(63) = 2.11, p = 0.04$ ). For women, although the median power coefficient was lower than 1, concavity was not significant (Wilcoxon,  $p = 0.94, t(63) = 0.84, p = 0.40$ ). The large spread of elicited utility parameters among women explains this result. On the other hand, we found more concave utility functions than convex utility functions for both women and men ( $p < 0.01$ ). For couples, we could not reject equality of counts of concave and convex utility functions ( $p = 0.16$ ).

We found high correlations both between couples' utility parameters and men's utility parameters ( $\rho = 0.68$ , significant at  $p < 0.01$ ) and between couple's utility parameters and women's utility parameters ( $\rho = 0.65$ , marginally significant at  $p = 0.09$ ). To evaluate the balance of power within the couple, we regressed couples' utility parameter on individual's utility parameters, assuming the linear constraint that individual weights sum to one. The linear constraint has two complementary

**Table 3** Women's bargaining weights in couple decisions

Model	1	2
Women's weight	0.401 (0.136)	0.404 (0.143)
Length of the relationship	-0.003 (0.006)	0.003 (0.004)
Children	-0.469** (0.174)	0.037 (0.131)
2 Children	0.169* (0.067)	-0.028 (0.039)
Age gap	-0.001 (0.011)	0.043 (0.014)
Observations	64	64 × 5
R <sup>2</sup>	0.240	0.389

Standard errors in parentheses (\* significant at 5%; \*\* significant at 1%). For women's bargaining weights, significance is measured towards equal weighting (one-half). Dependent variables are utility (model 1) and decision weights (model 2). Model 2 includes clustering for multiple answers by the same individual

interpretations. First, if the weights lie between 0 and 1, they can be interpreted as the balance of power in the couple. Second, if weights are outside the [0, 1] range, this means that the couples' utility are not well determined by a balance of power between the individuals. A potential drawback of the regression procedure is the potentially ill-defined nature of individual's weights in the decision-making process. Indeed, the regression is compatible with a collective model of the household but also with a dictatorship of one altruistic individual putting some weight on the preference of the other. To that respect, a better definition of the individual weights could be obtained by undertaking within-couple heterogeneity in individual characteristics. In what follows, we assume that individual weights depend on the partners' age gap, the length of their relationship, and the number of children, if any. Table 3 shows the results of the OLS regression in column 1 (model 1). The base weight associated with women's power over the couple decision equalled 0.404 (not significantly different from equal weighting). We found children to have a nonlinear effect on women weights: while the presence of one or two children decreased women's bargaining weights, having more than two children significantly increased women balance of power within the couple. We found no significant effect of neither the age gap nor the length or the relationship on the balance of power for utility.

### 5.2.2 Probability weighting

The second component of behavior toward risk under PT is probabilistic risk attitude, which is captured through probability weighting (Wu and Gonzalez 1996 for discussion). Table 4 gives the median decision weights along with the corresponding interquartile ranges. The median results are consistent with an inverse S-shaped probability weighting function for women, men, and couples: overweighting of small probabilities, underweighting of large probabilities. These inverse S-shaped functions have, however, different shapes for women, men, and couples: men were generally more optimistic than both their partner and their couple: men overestimated more small probabilities and underestimated less large probabilities.

**Table 4** Median values for decision weights

p	Women			Men			Couples		
	Median	IQR	t(63)	Median	IQR	t(63)	Median	IQR	t(63)
0.05	0.16	0.05–0.23	7.44**	0.16	0.09–0.29	8.09**	0.17	0.10–0.243	10.79**
0.25	0.27	0.16–0.36	1.24 <sup>ns</sup>	0.32	0.23–0.43	4.02**	0.28	0.22–0.39	3.27**
0.50	0.45	0.32–0.54	-2.97**	0.53	0.38–0.65	0.37 <sup>ns</sup>	0.46	0.40–0.57	-1.27 <sup>ns</sup>
0.75	0.61	0.52–0.71	-6.93**	0.70	0.58–0.81	-3.44**	0.66	0.55–0.74	-5.79**
0.95	0.81	0.68–0.87	-9.46**	0.86	0.74–0.93	-6.33**	0.84	0.74–0.90	-8.69**

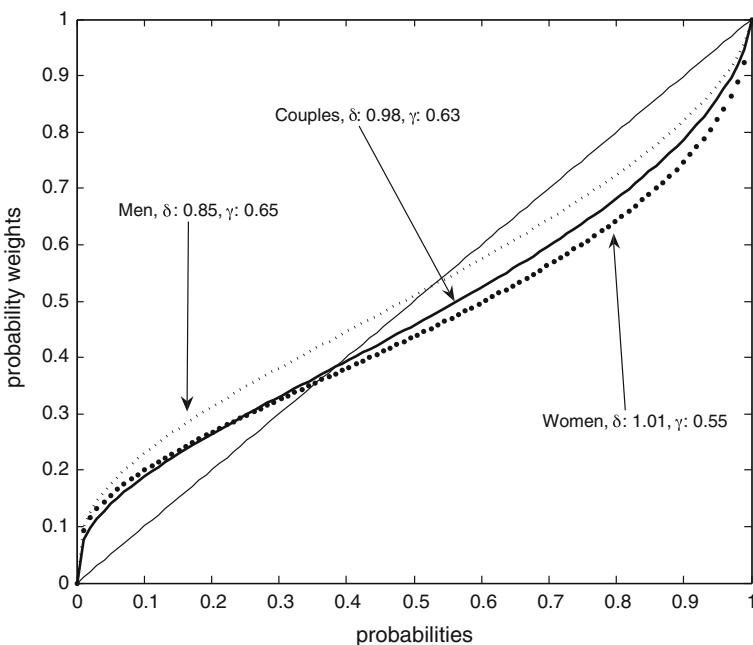
ns not significant, IQR interquartile range

t(63): two-tailed t test,  $H_0: w(p) = p$  \* significant at 5%; \*\* significant at 1%

Table 4 reports *t* tests supporting the view that probability 0.05 was overweighted and that probabilities 0.75 and 0.95 were underweighted for women, men, and couples. For women only, Table 4 also shows that probability 0.25 was not transformed and that probability 0.5 was underweighted. As regards men and couples, probability 0.5 was not transformed and probability 0.25 was overweighted. Paired *t* tests for binary comparisons (Table 7 in the Appendix) show that both men and women's probabilistic risk attitudes differed at all probability levels, except 0.95. This suggests that partners appeared to be similarly sensitive to the certainty effect (i.e., the strong impact of the shift from probability 0.95 to certainty), but not to the possibility effect (i.e., the strong impact of the shift from impossibility to probability 0.05). For the latter, men exhibited a higher overestimation of probabilities. Finally, partners did not behave similarly towards intermediate probabilities. A pooled regression for all probability levels, clustering for multiple responses, shows that women had a weight of 0.40 on decisions and men had a weight of 0.60 (Table 3, model 2). We found no significant effect of neither children, the age gap nor the length of the relationship on the balance of power for probabilistic risk attitude. Binary comparisons of probabilistic risk attitudes (Table 7 in the Appendix) show that couples' attitudes are significantly closer to men's risk attitudes at large probability levels and significantly closer to women's risk attitudes at low probability levels. Figure 2 presents elicited probability weighting functions based on the median responses for women, men, and couples. We used Prelec (1998) two-parameter compound invariance specification of the weighting function:  $w(p) = \exp(-\delta(-\ln p)^\gamma)$ , where  $\delta$  controls for optimism/pessimism and  $\gamma$  controls for insensitivity to changes in probabilities. Figure 2, plotted on median data, shows that probability weighting for couples lies within the boundaries of individuals' probability weighting. The only difference in parameters we found was between women's and couples' insensitivity to probability, with women being less sensitive [ $t(63) = 1.85$ ,  $p = 0.03$ , one-tailed paired test].

## 6 Conclusion

The first finding of this article is that correlations between risk attitudes within couples are rather weak. We observed no significant relation between men and women's



**Fig. 2** Probability weighting functions, median parameter values

risk-aversion. Hence, we found no support for assortative matching within the couple. Our results give support neither to Becker's theory of marriage which, assuming one-dimensional types of the partners, complementary in producing surplus, induces assortative matching (Becker 1973) nor to Chiappori and Reny (2006) risk-sharing model, where the more risk-averse men are matched with the less risk-averse women. Gierlinger and Laczó (2011) show that the existence of limits to commitment can produce positive assortative matching in the risk-sharing model. Following these steps, the unobserved heterogeneity in partners' limits to commitment in risk-sharing is a plausible explanation for the large heterogeneity in assortative matching observed in our experiment.

Second, our study shows that the probability weighting function for couples is inverse S-shaped. This result shows that this feature, standard in individual behavior, can be extended to couple behavior. Observing women's behavior seems to provide a better predictor of couple decisions at low-probability levels, while observing men's behavior provides the best predictor of couple decisions at high-probability levels. We also found that men were more optimistic than their partner and more optimistic than their couple in choice under risk. Such gender effect in optimism is consistent with existing experimental evidence on gender preferences (Croson and Gneezy 2009) as well as with the findings on overconfidence in financial decision making (Dellavigna 2009). Gender effects have also been observed in risky decisions by Fehr-Duda et al. (2006) who found that women underestimate large probabilities more than men do. An explanation could be that men are more overconfident than their partner about their

relative performance in individual risky tasks (Niederle and Vesterlund 2007) but that decisions in couples tend to correct.<sup>4</sup> Contrary to recent articles (Bruhin et al. 2011; Harrison and Rutström 2009), we did not find that women deviate more strongly from linear probability weighting than do men.

Third, correlations between men and women's overconfidence were close to zero in both cases. We found, however, that the couples' risk attitude was closer to the men's risk attitude at high-probability levels and closer to the women's risk attitude at low-probability levels. One interpretation of this result is that joint decision counter-balances probability weighting: men's overconfidence at low-probability levels and women's underconfidence at high-probability levels are both lowered in couple decisions. Accordingly, decision making in couples seems to reduce the distance between decision weights and objective probabilities. However, we did observe an inverse S-shaped probability weighting function for couples. This suggests that decisions resulting from the couple deliberative process do not completely eliminate the usual discrepancies between the descriptive model (PT) and the normative model (expected utility). Empirical evidence regarding comparisons between individual and collective decision making under risk supports this view. First, Sutter (2007) shows that loss aversion affects group decision making, even though it is lower than individual loss aversion. Second, Charness et al. (2007) find that deviations from the courses of action prescribed by normative models of decision making under risk, namely violations of first-order stochastic dominance in their experiment, are lower in groups but do not disappear, except when the group increases in size.

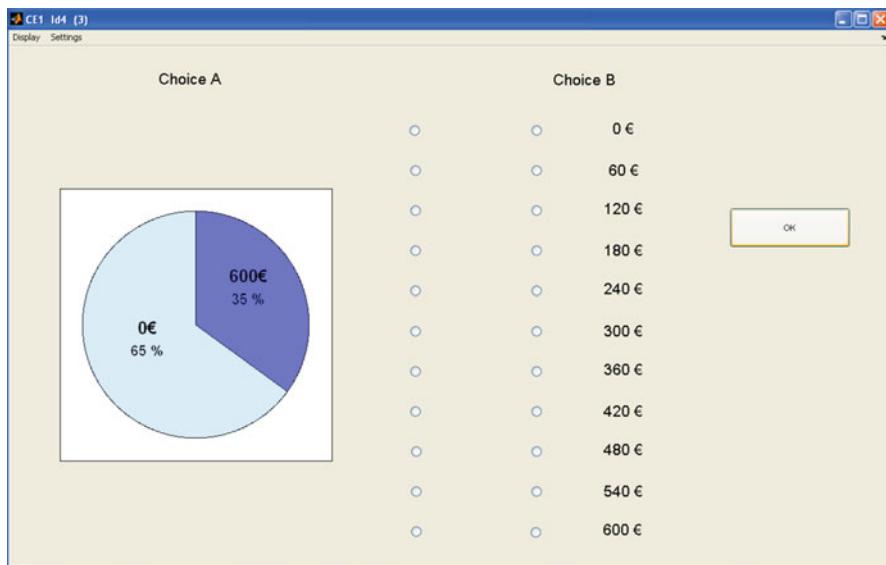
Of course, our experiment has several limits. First, the stakes used in the experiment (up to €1,200) are not high enough to capture some of the most important financial decisions made by couples. Second, we used only positive amounts of money in our analysis of couples' decision making. For a more complete understanding of couple decisions, it would be necessary to perform a distinct analysis of couples' behavior for losses, as well as for mixed prospects involving both gains and losses. This would provide a useful basis for the comparison of individuals' and couples' degrees of loss aversion. As the current experiment was already relatively long, we felt that a longer session including losses and mixed prospects would have been detrimental to the quality of the experimental data. Third, our analysis was restricted to couples' financial decisions involving monetary outcomes. It would be interesting to integrate our findings in a more general context taking into account the division of roles within the couple and the nature of altruism within the family.

## 7 Appendix

### 7.1 Stimuli

We used six certainty equivalence questions to elicit the utility function for gains. The prospects for which we determined the certainty equivalents are displayed

<sup>4</sup> Similarly, couples' decision would tend to correct women's underconfidence in performance at high-probability levels if any.



**Fig. 3** A typical display used in the experiment

**Table 5** Risky prospects used to elicit utility and weighting functions

Index $i$						Decision weights				
Utility						7	8	9	10	11
1	2	3	4	5	6					
$x_i$	600	900	900	1,200	900	1,200	1,200	1,200	1,200	1,200
$p_i$	0.35	0.35	0.35	0.35	0.35	0.35	0.05	0.25	0.50	0.75
$y_i$	0	0	300	300	600	600	0	0	0	0

in Table 5 ( $i = 1, \dots, 6$ ). The measurements were not chained and not vulnerable to error propagation. The probability  $p^*$  used to elicit utility was  $p^* = 0.35$ .

For the elicitation of decision weights, we used five certainty equivalence questions. We elicited decision weights for  $p = 0.05, 0.25, 0.50, 0.75, 0.95$  using  $x^* = 1200$  (Table 5,  $i = 7, \dots, 11$ ).

## 7.2 Certainty equivalents

See Tables 6, 7.

**Table 6** Certainty equivalents for utility and decision weights

Prospect index $i$	EV	Women		Men		Couple	
		Median	IQR	Median	IQR	Median	IQR
1	210	206	150–281	201	150–300	221	180–300
2	315	327	250–400	300	200–400	310	278–400
3	510	501	450–572	506	450–600	501	480–600
4	615	600	500–680	620	550–750	600	550–700
5	705	721	701–750	750	701–775	750	701–776
6	810	801	765–900	851	801–900	845	801–900
7	60	150	101–251	104	71–275	200	101–300
8	300	300	240–401	300	200–445	322	240–465
9	600	575	401–655	563	401–750	581	480–655
10	900	750	600–900	800	661–900	800	655–880
11	1,140	1,001	802–1,001	1,001	873–1,100	1,001	900–1,080

EV expected value, IQR interquartile range

**Table 7** Binary comparisons of decision weights

Probability	Women vs. men	Women vs. couples	Men vs. couples
	p	t(63)	t(63)
0.05	-1.93*	-0.45ns	2.03*
0.25	-2.22*	-1.09ns	1.87*
ns not significant			
t(63): Student's <i>t</i> , one-tailed paired test * significant at 5%; ** significant at 1%	0.50	-2.20*	-1.66ns
	0.75	-2.27*	-1.86*
	0.95	-1.53ns	-2.00*
			-0.28ns

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