Economics Letters 124 (2014) 96–99

Contents lists available at ScienceDirect

Economics Letters

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

A note on coupled lotteries

Marc T.P. Adam[a,*], Eike B. Kroll[b], Timm Teubner[a]

[a] Karlsruhe Institute of Technology, Germany

[b] buw consulting GmbH, Germany

HIGHLIGHTS

- Experimental analysis of individual, symmetric and asymmetric lotteries.
- When payoffs are symmetrically coupled, subjects make more risky choices.
- When payoffs are asymmetrically coupled, subjects make less risky choices.
- Subjects with persistent choices behave more risk averse.

ARTICLE INFO

Article history:
Received 2 February 2014
Received in revised form
16 April 2014
Accepted 25 April 2014
Available online 5 May 2014

JEL classification:
D8
C9

Keywords:
Other-regarding preferences
Decision under risk
Lottery choice

ABSTRACT

We study the impact of coupling a decision maker's lottery payoffs to those of a peer on the preferred level of risk by means of a lab experiment. Compared to the benchmark where the lotteries are paid off individually, symmetrically coupled payoffs increase the willingness to take risks, whereas asymmetrically coupled payoffs have the opposite effect. Moreover, subjects with persistent choices in the different conditions behave more risk averse than subjects with non-persistent behavior.

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1. Introduction

The literature on other-regarding preferences mostly abstracts from uncertainty and focuses on deterministic scenarios; "few contributions investigate risk taking in a social context" (Bolton and Ockenfels, 2010, p. 628). However, recent theoretical and experimental work is increasingly concerned with the interplay of both aspects (see Trautmann, 2009; Trautmann and Vieider, 2011; Gantner and Kerschbamer, 2011). Trautmann and Vieider (2011) found that fairness motives and uncertainty interact if (a) the decision maker observes the payoff of other agents they consider relevant, (b) the outcome of another person serves as a reference point, and (c) people aim for conformity with their peers' behavior. Therefore, creating a social context in risky choice situations is likely to affect decisions. This holds even when subjects only affect their own payoffs or chances without any impact on others' payoffs. Weigold and Schlenker (1991) found that especially risk averse subjects are affected when their choices are observed by a passive partner and reduce their risk tolerance. In contrast, originally risk seeking subjects showed higher risk tolerance.

The question how peer presence affects risk tolerance is important since many decisions take place within a social context (e.g., management decisions, social trading, and gamified applications). Various experiments analyzed choices where risk is introduced to a social context, e.g., probabilistic dictator games where not the payoff is distributed but the probabilistic chance of winning the complete amount (Karni et al., 2008; Krawczyk and Le Lec, 2010; Brock et al., 2013) or where uncertainty about the pie size is introduced (Haisley and Weber, 2010; Ockenfels and Werner, 2012). Brennan et al. (2008) and Güth et al. (2008) analyzed subjects' willingness to pay and accept for prospects with different combinations of payoffs to oneself and a peer. Other scholars focused on situations with decisions explicitly on behalf of a peer (Chakravarty et al., 2011; Pahlke et al., 2010; Charness and Jackson, 2009), or where a deliberate departure from one's own

* Correspondence to: Karlsruhe Institute of Technology, Kaiserstr. 12, Bldg. 01.80, 76131 Karlsruhe, Germany. Tel.: +49 721 6084 8372; fax: +49 721 6084 8399.
E-mail address: marc.adam@kit.edu (M.T.P. Adam).

http://dx.doi.org/10.1016/j.econlet.2014.04.024
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preferred level of risk benefits another player (e.g., Bradler, 2009). All of these studies analyzed choice situations where at least one of the subjects directly affected the other's payoff.

Other studies, similar to ours, created the social context by the existence of a passive partner. Linde and Sonnemans (2012), found that participants exhibited higher risk aversion when they could earn at most as much as a passive partner (who received a fixed payoff), compared to when they were ensured to earn at least as much. The passive partner seemed to create a social reference point. Prospect Theory, however, does not predict this behavior. Cooper and Rege (2011) considered the impact of peer group choices and concluded that "social interaction effects driven by social regret can cause peer group effects" (p. 109), meaning that an observed choice increases the decision maker's tendency to choose the observed level of risk as well. Gantner and Kerschbamer (2011) complemented this finding in an experiment in which they explicitly abstracted from material externalities, information on outcomes, and stochastic dependence. They found that being exposed to the decisions of a fictitious peer in risky choices, the decision maker's level of risk shifts towards that of the peer. Bault et al. (2008) matched participants with fictitious peers and analyzed the impact of lottery outcomes on arousal. They found that contrary outcomes (one loses, the other wins) caused stronger physiological reactions than when participants win or lose concurrently.

While most prior studies confronted subjects with risky decisions in light of a peer's outcome or choice (*ex-post*), there exist few insights about the impact of how chances and payoffs are coupled from an *ex-ante* perspective, i.e. before the decision maker knows anything about the other's actions or results, except that there *is* another player. In our paper, we address such ex-ante decisions and systematically vary the social context by altering the way in which the participants' outcomes are coupled.

2. Experimental design

Every participant successively faced 3 risk preference elicitation tasks, similar to Holt and Laury (2002), using a within-subject design with varying sequence. The 3 tasks each consisted of 21 choices between 2 alternative lotteries A and B. Every lottery had a high (A: € 20, B: € 15) and a low payoff (A: € 0, B: € 5). The choice set is represented in Table 1. The experiment was conducted using pen and paper at the Institute of Information Systems and Marketing at Karlsruhe Institute of Technology in Karlsruhe, Germany. Altogether, 140 subjects were recruited using ORSEE (Greiner, 2004). Subjects were seated in separated cabins, communication was not allowed. They did not see each other prior or during the experiment.

To investigate the influence of the social context, we manipulated the way the subjects' payoff is linked to that of a partner. The social context was established by the payoff procedure. Depending on the treatment, subjects were called for payoff individually, or in pairs of two. In the latter case, they could observe their (randomly assigned) partner's decisions and result. At the time of decision making, participants did not know or get to see the partner.

First, in the control treatment, lotteries were not coupled but realized for each subject *individually* (IND). Second, in the *symmetric* treatment (SYM), lotteries were symmetrically coupled, i.e., either both subjects received the low or the high payoff of their respective lottery choice. Third, in the *asymmetric* treatment (ASYM), lotteries were asymmetrically coupled, i.e., one subject received the high payoff (€ 20 or € 15) while the partner inevitably received the low payoff (€ 0 or € 5). Note that the difference between the players' payoffs in the SYM treatment can at most be € 5 (i.e. € 0 or € 5), whereas it is at least € 10 (i.e. € 10, € 15, or € 20) in the ASYM treatment for any combination of choices. While these "guaranteed" differences were deliberately not highlighted in the instructions, they were implicitly available to subjects by comparing the payoffs on the decision sheet. Neither partner's identity nor choice was known at the time of decision making.

Finally, a dice roll determined the relevant choice set for all participants of a particular session. Then, subjects either individually (IND) or in random groups of two (SYM, ASYM) were called to the experimenter. First, one of the 21 rows was selected with equal probabilities. Then an urn was equipped with 20 balls of 2 colors where the proportions of the colors reflected the probabilities. Then the lottery was played out for one (IND), or for the 2 subjects of the current group with a single draw from the urn (SYM, ASYM). In the SYM treatment, the high payoffs were associated with one, and the low payoffs with the other color. The ASYM treatment realized asymmetrical coupling by one color identifying the high payoff for one subject and the low for the other.

3. Results

Expectedly, subjects behave risk averse on average ($\#sc_{\text{overall}} = 14.567 > 11 = \#sc_{\text{risk neutral}}$). Altogether, 35 subjects (25%) chose the same number of safe choices in all 3 treatments. We refer to this behavior as *persistent*. In contrast, 105 subjects (75%) deviated at least once (SYM and/or ASYM) from the number of safe choices in the IND condition. We refer to this behavior as *non-persistent*. The comparison of persistent and non-persistent subjects reveals that persistent subjects ($N = 35, M = 15.486, SD = 2.994$) made more safe choices than non-persistent subjects ($N = 105, M = 14.260$, $SD = 2.883$) (two-tailed independent samples Wilcoxon test: $Z = -2.445,\ p = 0.015$).

Result 1. *Subjects with persistent choices reveal a higher degree of risk aversion than subjects with non-persistent behavior.*

The majority made varying numbers of safe choices across treatments. A Friedman test reveals that these treatment differences are systematic ($\chi^2 = 15.961, p < 0.001$, average ranks $\text{ar}_{\text{sym}} = 1.73, \text{ar}_{\text{ind}} = 2.04, \text{ar}_{\text{asym}} = 2.23$). We now focus on these non-persistent subjects. The analysis shows that subjects made a lower number of safe choices in the SYM condition than in the IND condition (two-tailed paired samples Wilcoxon test, $Z = -2.554, p = 0.011$).

Result 2a. *Subjects make riskier choices when the payoffs are symmetrically coupled, compared to the benchmark treatment with individual payoffs.*

The number of safe choices in the SYM condition is also smaller than in the ASYM condition ($Z = -3.435,\ p < 0.001$). The number of safe choices in the baseline condition IND lies in the middle of SYM and ASYM. It is smaller than in the ASYM condition, this difference, however, is only marginally significant ($Z = -1.736$, $p = 0.083$).

Result 2b. *Subjects make less risky choices when the payoffs are asymmetrically coupled, compared to the benchmark treatment with individual payoffs.*

We believe that the difference in risk tolerance between persistent and non-persistent subjects (Result 1) substantiates the need for a broken down analysis. Note, however, that Result 2a and Result 2b are robust towards including the persistent subjects (SYM vs. IND: $Z = -2.666, p = 0.008$; SYM vs. ASYM: $Z = -3.488, p < 0.001$; IND vs. ASYM: $Z = -1.757, p = 0.079$). Similar to above, the difference between IND and ASYM is only marginally significant.

Overall, as can be seen in Fig. 1, the number of safe choices follows the distinct pattern SYM < IND < ASYM ($M_{\text{SYM}} = 13.762$,

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