16- Incentive Effects on Risk Attitude in Small Probability Prospects

Mathieu Lefebvre
University of Liège, CREPP

Ferdinand M. Vieider[*]
Ludwig-Maximilians-University, Munich

Marie Claire Villeval
University of Lyon, CNRS, GATE; IZA, Bonn, and CCP, Aarhus

Abstract: We report between-subject results on the effect of monetary stakes on risk attitudes. While we find the typical risk seeking for small probabilities, risk seeking is reduced under high stakes. This suggests that utility is not consistently concave.

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1. INTRODUCTION

One issue that has been debated in the literature regarding decision making under risk is the effect of the provision of monetary incentives when studying risk attitudes. As for many other economic decisions (Camerer & Hogarth, 1999; Johansson-Stenman *et al.,* 2005; Kocher *et al.*, 2008), the effect of incentives is a potentially contentious issue, since many of the traditional findings on risk attitudes have been obtained using hypothetical payoffs.

After many years of heated debate, a consensus on these issues is emerging. Incentives are generally thought to leave intact the qualitative findings obtained with hypothetical studies (Battalio *et al.*, 1990). Quantitatively, however, incentives seem to matter inasmuch as higher stakes increase risk aversion (Binswanger, 1980; Kachelmeier & Shahata, 1992). Also, while the size of real stakes matters, so do the nominal stakes in hypothetical choices (Kühberger *et al.*, 2002; Holt & Laury, 2002).

Although these studies have produced a generally coherent view, some methodological doubts remain. Indeed, the studies all report results from within-subject investigations of risk attitudes. While within-subject investigations are statistically powerful, they raise the issue of sequentiality of effects, as later choices may be influenced by earlier ones. For instance, Kachelmeier & Shehata (1992) remark how "the transparent manipulation of prize level may have acted as a cue to subjects that their responses should change" (p. 1131) . Read (2005) criticizes Holt & Laury (2002) for repeatedly telling subjects that certain choices were hypothetical and that others were real, thereby possibly influencing the subjects' behavior.

To the best of our knowledge, no systematic investigation has been undertaken of the between-subject effects of different stakes on risk attitude. Some consider between-subject data to be the gold standard against which all other results need to be measured (Poulton, 1973). Without agreeing with these arguments, we think that such data may provide additional insights. We thus present some results on the effect of stake-size on risk attitudes for small probability prospects. Even though, for budgetary reasons, our attention is restricted to small probabilities, the changes in stakes are substantial, ranging from prizes of €4 ($6) to prizes of €100 ($150). While we find the typical pattern of risk seeking for small probabilities under low monetary stakes, we show that such risk seeking is substantially reduced under high stakes.

2. THE EXPERIMENT

2.1 Method

Subjects. The experiment was conducted at GATE, University of Lyon, France. Four sessions were run, with 20 subjects taking part in two of the sessions and 19 subjects in the other two. 64% of the subjects were female; the average age was 22. On average, subjects earned €22.58 for an experiment lasting less than 30 minutes.

Tasks. Subjects participated in several tasks in the course of an experiment on probability representations, as described in Lefebvre *et al.* (2010). Since different probability representations were found to have no effect, we will not discuss this issue further. Two tasks relevant to this paper were used. First, a context-free *neutral task* was used to elicit certainty equivalents for a binary lottery offering a 10% probability of winning a prize and a complementary probability of winning nothing. Certainty equivalents were elicited through a list of 26 choices (see Appendix).

Next, subjects' willingness to invest in a risky project was explored. Subjects were given an initial endowment, and the amount subjects were willing to invest was elicited through a list of 12 choices. Subjects were randomly assigned one of three probabilities of investment success ranging between 5.9% and 7%. Since ratios of elicited values to expected value (*EV*) are used for the analysis, this small variation in probabilities does not affect the results.

Incentives. A show-up fee of €5 was provided to all subjects. In the Low-Stakes condition, the prizes were €10 ($15) for the neutral task, and €4 ($6) for the investment task, with this task being financed out of an initial endowment of €0.60 (90¢). In the High-Stakes condition, all amounts were increased by a factor of 10, implying prizes of €100 ($150) and €40 ($60) for the neutral and investment tasks, respectively.

Encoding. The certainty equivalent (*CE*) and the willingness-to-pay for investment (WTP) were calculated as the mean between the two amounts for which subjects switched from the prospect to the certain amount (in the case of CE), or from the certain amount to the prospect (in the case of WTP).

Hypotheses. We expected that subjects would on average be risk seeking. Furthermore, we expected that risk seeking would be reduced significantly in the High-Stakes condition in

comparison with the Low-Stakes condition.

2.2 Results

Neutral task. Six subjects were dropped from the sample because they switched multiple times between the certain amount and the prospect. Under low stakes, we found risk seeking behavior, with a mean ratio of CE to EV of 1.66. We thus strongly reject the hypothesis that subjects are expected value maximizers ($t(39) = 8.53$, $p < 0.001$; all p-values are two-sided) in favor of the hypothesis that subjects are risk seeking. Only two subjects out of 40 can be classified as risk averse, three as risk neutral, and the remaining 35 as risk seeking (see Table 1).

Table 1: Classification of subjects in terms of risk attitude

Tasks	Condition	Distribution of risk attitudes			
		Risk averse	Risk neutral	Risk seeking	Total
Neutral task	Low stakes	2 (5.00)	3 (7.50)	35 (87.50)	40 (100)
	High stakes	14 (43.75)	6 (18.75)	12 (37.50)	32 (100)
Investment task	Low stakes	5 (12.50)	2 (5.00)	33 (82.50)	40 (100)
	High stakes	9 (26.47)	2 (5.88)	23 (67.65)	34 (100)

Note: Relative frequencies in parentheses

In the High-Stakes condition, subjects are approximately risk neutral, with an average ratio of CE to EV of 0.96. The hypothesis of risk neutrality can thus not be rejected ($t(31) = -0.44$, $p = 0.67$). 14 subjects can be classified as risk averse, six as risk neutral, and 12 as risk seeking. We thus confirm that, in the High-Stakes condition, subjects are on average significantly less risk seeking than in the Low-Stakes condition ($z = 4.74$, $p < 0.001$, Mann-Whitney test).
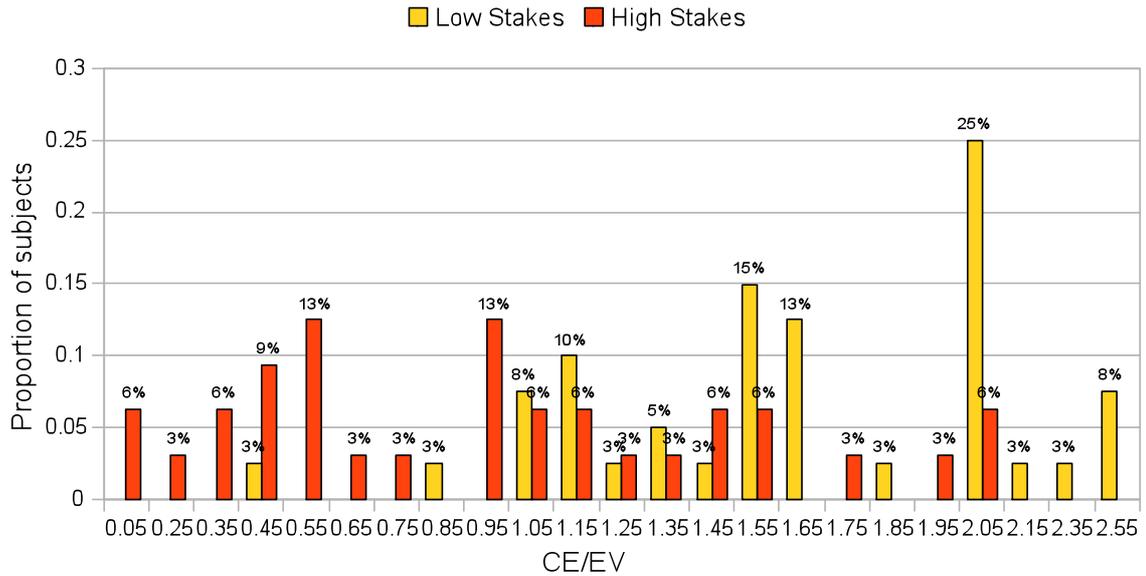
Figure 1: Ratio of CE to EV for Low- and High-Stakes conditions

Investment Task. Six subjects were eliminated because they switched several times between the options of investing and not investing. Again, we found risk seeking under low stakes, with a mean ratio of WTP to EV of 1.88. We can easily reject risk neutrality in relation to this task ($t(37) = 6.05$, $p < 0.001$). Five subjects can be classified as risk averse, two as risk neutral, and 33 as risk seeking (see Table 1). Under high stakes we also found risk seeking behavior, with the mean WTP to EV ratio equal to 1.52. This time we can also reject risk neutrality for high stakes ($t(33) = 3.31$, $p = 0.002$). Nine subjects are risk averse, two risk neutral, and 23 risk seeking. As hypothesized, subjects in the High-Stakes condition are on average less risk seeking than subjects in the Low-Stakes condition ($z = 1.93$, $p = 0.05$; Mann-Whitney test) (see also Figure 2).
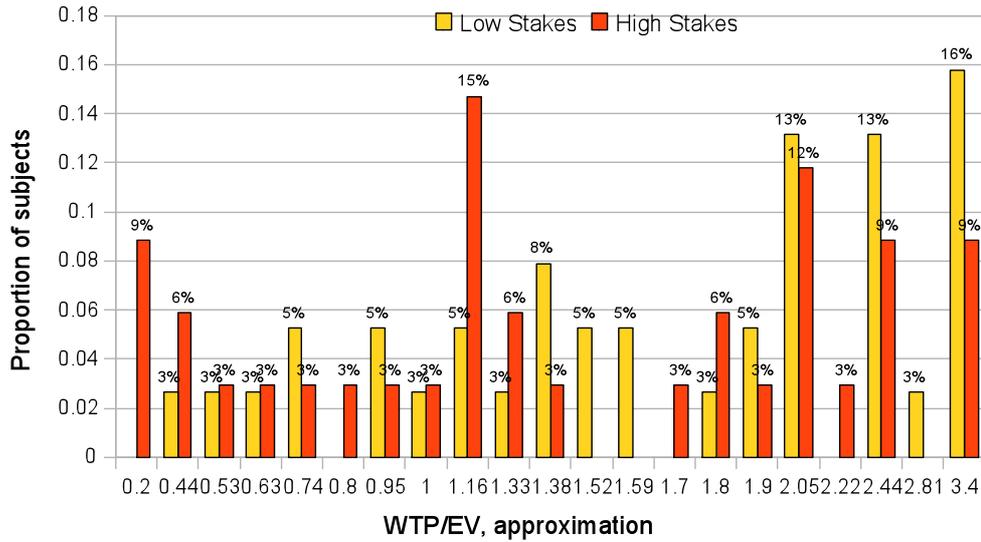
Figure 2: Proportion of subjects by WTP/EV ratio

3. DISCUSSION

Our data confirm previous findings according to which individuals become more risk averse—or in our case less risk seeking—when high stakes are involved. This effect is very strong for a neutral task in which CEs are elicited. The effect is replicated in an investment task, though it is significantly less strong in that case ($Z = 1.49$, $p = 0.06$, Fisher's z test). Subjects are found to be risk seeking for small probabilities, as predicted by the overweighting of small probabilities generally found in the literature (Abdellaoui, 2000; Bleichrodt & Pinto, 2000). While subjects become risk neutral under high incentives for the neutral task, they remain risk seeking for the investment task.

Under prospect theory the difference between low and high stakes can be explained in terms of attitudes towards outcomes, since probability weighting is a purely probabilistic matter. The strong reduction in risk seeking we find is, however, somewhat troubling, since it is generally assumed that utility should be linear for such small amounts (Abdellaoui *et al.*, 2008; Booij & van de Kuilen, 2009). A potential explanation would be that utility is not consistently concave over the outcome space, but rather it contains a convex section for very small amounts (Bosch-Domènech & Silvestre, 1999; Markowitz, 1952).

According to this *peanut effect* (Prelec & Loewenstein, 1991; Weber & Chapman, 2005), the extreme risk seeking found would be the result of an increasing marginal utility of money for the small amounts of money offered for certain. Notice how this conceptual

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framework may also explain why we find a weaker effect of monetary stakes in the investment task. Indeed, the certain amounts used in this investment task are even smaller and may thus be undervalued in both conditions, resulting in in a perpetuation of risk seeking in the High-Stakes condition.

4. CONCLUSION

Although several studies have investigated the effect of high monetary stakes on risk attitude, data reported are generally obtained by means of within-subject designs, and doubts have been raised regarding the soundness of that approach. In the present study, we tested the effect of high monetary stakes for small probability prospects in a between-subject design. While we discovered a typical pattern of risk seeking for small probability prospects under low stakes, such risk seeking was found to be substantially reduced under high stakes. This could be explained by a peanut effect, according to which the utility curve may have a convex section for low gain amounts.

APPENDIX

Neutral Task (High stakes):

Below you are asked to choose repeatedly between different certain amounts and a draw from an urn containing **1** red ball(s) and **9** black balls. The prize for drawing a red ball from the urn is **EUR 100**.

In the payoff determination phase, one of your choices below will be selected at random. In case you have chosen the sure amount in the selected choice, you will simply be paid that amount. In case you have chosen the extraction, one ball will be extracted from the urn: if the ball is red, you will be paid EUR 100; if the ball is black you will obtain nothing.

○ I choose EUR0.5 for sure	○ I choose the extraction
○ I choose EUR1 for sure	○ I choose the extraction
○ I choose EUR2 for sure	○ I choose the extraction
○ I choose EUR3 for sure	○ I choose the extraction
○ I choose EUR4 for sure	○ I choose the extraction
○ I choose EUR5 for sure	○ I choose the extraction
○ I choose EUR6 for sure	○ I choose the extraction
○ I choose EUR7 for sure	○ I choose the extraction
○ I choose EUR8 for sure	○ I choose the extraction
○ I choose EUR9 for sure	○ I choose the extraction
○ I choose EUR10 for sure	○ I choose the extraction
○ I choose EUR11 for sure	○ I choose the extraction
○ I choose EUR12 for sure	○ I choose the extraction
○ I choose EUR13 for sure	○ I choose the extraction
○ I choose EUR14 for sure	○ I choose the extraction
○ I choose EUR15 for sure	○ I choose the extraction
○ I choose EUR16 for sure	○ I choose the extraction
○ I choose EUR17 for sure	○ I choose the extraction
○ I choose EUR18 for sure	○ I choose the extraction
○ I choose EUR19 for sure	○ I choose the extraction
○ I choose EUR20 for sure	○ I choose the extraction
○ I choose EUR21 for sure	○ I choose the extraction
○ I choose EUR22 for sure	○ I choose the extraction
○ I choose EUR23 for sure	○ I choose the extraction
○ I choose EUR24 for sure	○ I choose the extraction
○ I choose EUR25 for sure	○ I choose the extraction

OK

Investment Task: Choice List

You are now given a **EUR 6 endowment**.

You must ow decide whether to keep that money or use it to make a potentially lucrative investment. Imagine this situation: a colleague of yours has offered you the opportunity to buy a share in a new clean energy project. Given the massive demand by governments for renewable energy, this investment offers a **payoff of EUR 40**.

However, there is a chance that your technology will be abandoned in favor of a more promising technology. You know that there are **1000 alternative projects** being implemented, of which **59 will finally be pursued** and hence produce their promised payoffs.

Please indicate in the list below how much of your EUR 6 endowment, if any, is the maximum amount you would be willing to invest. One of your choices will be selected for real play. If you have chosen not to invest, you keep your EUR6. I you have chosen to invest, the price will be deduced from your endowment and the investment will be played out. If your investment is successful, you get EUR40 plus what remains of your endowment, if not you obtain only what remains of your endowment.

○ I choose to invest in the project for EUR0.5	○ I prefer not to invest
○ I choose to invest in the project for EUR1	○ I prefer not to invest
○ I choose to invest in the project for EUR1.5	○ I prefer not to invest
○ I choose to invest in the project for EUR2	○ I prefer not to invest
○ I choose to invest in the project for EUR2.5	○ I prefer not to invest
○ I choose to invest in the project for EUR3	○ I prefer not to invest
○ I choose to invest in the project for EUR3.5	○ I prefer not to invest
○ I choose to invest in the project for EUR4	○ I prefer not to invest
○ I choose to invest in the project for EUR4.5	○ I prefer not to invest
○ I choose to invest in the project for EUR5	○ I prefer not to invest
○ I choose to invest in the project for EUR5.5	○ I prefer not to invest
○ I choose to invest in the project for EUR6	○ I prefer not to invest

OK

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