Risk Aversion and Incentive Effects: New Data without Order Effects

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Holt and Laury (2002) used a menu of ordered lottery choices to make inferences about risk aversion under various payment conditions. The main results of that paper were: (a) subjects are risk averse, even for relatively small payments of less than $5; (b) risk aversion increases sharply with large increases in the scale of cash payoffs; and (c) there is no significant effect from increasing the scale of hypothetical payment. With a few exceptions noted in the paper, all treatments began with a low-payment choice, followed by a choice with hypothetical payments that had been scaled up (by 20×, 50×, or 90×), followed by a real-cash decision with the same high payment scale (20×, 50×, or 90×), followed by a single, final, low (1×) real payment choice. Those in the 90× treatment could earn amounts ranging from $9.00 to $346.50 in this task. As Glenn W. Harrison et al. (2004) correctly note, this design confounds order and treatment effects since the high real payment choice was always completed *after* the low real and high hypothetical payment tasks.

In a new experiment reported below, we first seek to replicate Harrison et al.'s finding that the order effect (participating in a low-payment choice before making a high-payment choice) magnifies the scale effect. In a second treatment, each subject completes the menu of lottery choices under just one payment condition (1× or 20×, real or hypothetical), thereby eliminating any order effects.

I. New Data

The new experiment was conducted in 2004 using 216 subjects recruited from undergraduate economics classes at the University of Virginia.[1] As in our previous experiment, each session began with a lottery choice "trainer" and a second unrelated experiment. Results are presented in Table 1. For comparison, we include data from the Holt and Laury (2002) experiment, as shown in the top two rows of Table 1, and from Harrison et al.'s (2005) experiment in rows three and four.

In the first treatment of our new experiment, 48 subjects completed a real low-payment choice, followed by a real high-payment choice, in which all choices were scaled up by a factor of 20.[2] Results are presented in Table 1, row 5. The average number of safe choices for the low (1×) real treatment is shown in row five as 6.1. When real cash payments are scaled up by a factor of 20, the average number of safe choices made by these subjects increased to 7.1. As can be seen, subjects from the new experiment are somewhat more risk averse than those used in the earlier studies; however, the scale effect (from 1× to 20×) with cash payments is essentially the same as that of our previous experiment. In both cases, the average number of safe choices increased by approximately one safe

[1] Unlike the experiment reported in Holt and Laury (2002), decisions were recorded using a computer interface. The die-throw, however, was still done by the experimenter by hand. Also, the left/right order of the safe and risky options was alternated in successive 12-person sessions. The order of presentation did not matter, and so we pool the data from both presentation orders.

[2] As in our original experiments, as a rough control for wealth effects, a person had to agree to give up the payment from the first (1×) choice in order to participate in the high-payment choice. One subject did not agree to participate in the high-payment choice, stating that she felt she had earned enough in the experiment already. Omitting this subject from the following analysis has no effect on these results.

TABLE 1—AVERAGE NUMBERS OF SAFE CHOICES: ORDER AND INCENTIVE EFFECTS

Experiment	Treatment	1×	10×	20×	50×	90×
Holt and Laury (2002)	1. Real (ordered)	5.2[a]		6.0[c]	6.8[c]	7.2[c]
U.C.F., Ga. St., U. Miami 208 subjects	2. Hypothetical (ordered)			4.9[b]	5.1[b]	5.3[b]
Harrison et al. (2004)	3. Real (ordered)	5.3[a]	6.4[b]			
South Carolina 178 subjects	4. Real (unordered)		6.0[a]			
New experiments (2004)	5. Real (ordered)	6.1[a]		7.1[b]		
U. of Virginia 216 subjects	6. Real (unordered)	5.7[a]		6.7[a]		
	7. Hypothetical (unordered)	5.6[a]		5.7[a]		

Note: Superscripts indicate order ([a] = 1st, [b] = 2nd, [c] = 3rd).

choice as the scale increased by a factor of 20. We use a Kolmogorov-Smirnov test to identify differences between the distributions of the number of safe choices made at the low- and high-payment levels.[3] There is a significant difference between the distributions of safe choices between these two payoff-scale conditions ($p < 0.01$). This test does not, however, explore the extent to which this payoff-scale effect is due to the fact that the 20× choice was made after the 1× choice.

We conducted four additional treatments in which each subject completed a *single* lottery-choice menu that was identical to that described above. Unlike our first treatment (with ordered choices), however, these subjects participated in just one payoff treatment. The four (unordered) treatments tested were: low (1x) real payments, low hypothetical payments, high (20x) real payments, and high hypothetical payments. There were 48 subjects in each real-payment treatment, and 36 subjects in each hypothetical-payment treatment.[4] Instructions for all treatments were identical, except for the description of the actual choices the subjects faced.[5]

The data from the single-choice treatments are summarized in the bottom two rows of Table 1. Those subjects who completed the low-real-payment decision were slightly less risk averse than those who completed the ordered task reported above (those in the low-real-payment treatment made 5.7 safe choices compared with 6.1 for those who participated under both payment conditions). A Kolmogorov-Smirnov test, however, cannot reject the null hypothesis of equal distributions between these two low-payment treatments (two-sided p-value = 0.50). A Wilcoxon rank-sum test also fails to reject the null hypothesis of equal distributions and central tendency ($p = 0.33$).

The increase in the number of safe choices from the low-real to high-real payment conditions is identical (1 safe choice) between these treatments with ordered data in row 5 and those with unordered data in row 6, which indicates that real payoff-scale effects are important, whether or not decisions are made in an ordered or unordered manner. Again, a Kolmogorov-Smirnov test fails to reject the null hypothesis of

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[3] The Kolmogorov-Smirnov test looks for differences in the two distributions, both in terms of shape and location. It has good power to test for general differences in distributions, and not just in the central tendency of two distributions.

[4] Each hypothetical-payment treatment had 24 subjects making decisions with the "safe" lottery on the left, and 12 subjects making decisions with the "safe" lottery on the right. The numbers were balanced in the real-payment treatments, with 24 subjects in each order.

[5] Instructions are available on line at http://veconlab. econ.virginia.edu/admin.htm. To view the on-line instructions, go to the Decisions Menu and then select Lottery Choice Menu program. You may use the session name

"test" to set up an experiment. Instructions can be seen by pressing the Instructions button on the final Admin Results page in the setup sequence. In the hypothetical payment treatments, the final line of the instructions noted that payoffs would not be paid, and the experimenter added a verbal comment: "Unlike the other tasks that you have done so far today, the earnings for this part of the experiment are hypothetical and will not be added to your previous earnings." Under the real-payoff condition, the experimenter finished the instructions by announcing to participants, "Your earnings for this part of the experiment are real and will be paid in cash when we finish." Subjects recorded their own earnings on a receipt form, and there seemed to be no confusion between treatments about whether the earnings would be paid or not.

equal distributions of safe choices in the two high-real-payment treatments in rows 5 and 6, even if one has an a priori belief that the distribution of safe choices under the 20× treatment, when conducted alone, will lie to the left of that when the 20× choice follows the low-payment task (one-sided p-value $= 0.18$). A Wilcoxon test, however, rejects the null hypothesis at a 10-percent level of significance (one-sided p-value $= 0.09$).

While the effect of prior experience with a low-payment decision on subsequent choices is not clear-cut at the 20× level, these four unordered treatments confirm the primary conclusions of Holt and Laury (2002). Considering only those treatments in which subjects participated in a single payment condition (the last two rows of Table 1), there is a significant difference in the distribution of safe choices under low- and high-real-payment conditions (Kolmogorov-Smirnov, one-tailed p-value $= 0.01$). There is no significant difference, however, in the distribution of safe choices under the corresponding hypothetical payment conditions ($p = 0.42$). Therefore, even when order-effects are eliminated, scaling up payments by a factor of 20 leads to a significant increase in risk aversion, but only when using real payments.

II. Conclusion

Harrison et al. (2005) correctly note that the estimate of an individual's degree of risk aversion may be biased if the subject first completes the same decision-problem under a different payoff scale. In response, we conducted a new experiment in which subjects completed a menu of lottery choices under a single payment condition, in order to eliminate order effects. Both our new data, and Harrison et al., confirm that scaling up real payments results in a significant increase in risk aversion. Our new data further demonstrate that scaling up hypothetical payments by the same amount does not cause a significant difference in risk aversion when possible order effects are eliminated.

REFERENCES

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