Payoff Scale Effects and Risk Preference Under Real and Hypothetical Conditions

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I. Introduction

Economists are primarily concerned with decisions that involve monetary consequences, and therefore, laboratory economics experiments almost always use financial incentives. The psychologist Sidney Siegel established the importance of using real (instead of hypothetical) payments. For example, Siegel and Goldstein (1959) report a "probability matching" experiment in which subjects had to predict which of two light bulbs would be illuminated in a sequence of trials. For at least 20 years, psychologists had conducted probability-matching experiments, concluding that subjects consistently violated rationality assumptions. However, when Siegel and Goldstein (1959) paid subjects a small reward for correct choices, optimal behavior was observed more than 90 percent of the time.

Of course, when more interesting tasks are used, incentives may not matter as much. For example, subjects may enjoy playing out choices among risky prospects, regardless of whether they are paid based on the outcome. If using real incentives does not matter, conducting experiments with hypothetical payments is an attractive, inexpensive alternative. There is an additional (frequently cited) motive for using hypothetical payments. If the naturally occurring decisions of interest involve substantial sums of money (for example, purchasing insurance against large losses), it is not feasible to pay experimental subjects comparable sums of hundreds or thousands of dollars. If "people often know how they would behave in actual situations of choice, and … the subjects have no special reason to disguise their true preferences" (Kahneman and Tversky, 1979, p. 265) then it may be preferable to use high hypothetical payments over the low real payments typically used in the lab.

The effect of using hypothetical payments is not yet settled. Smith and Walker (1993) report that mean bidding behavior in auctions is little affected by the choice of payment method, but that noise is reduced when payments are real. In a follow-up paper, Tversky and Kahneman (1992) state that none of their conclusions are contradicted when real payoffs are used.

These are important procedural issues, and it is natural to use experiments to evaluate them. This chapter summarizes some recent evidence on the effects of payoffs on risk attitudes. In particular we compare choices under real and hypothetical incentives, and look at the effect of payoff scale (up to several hundred dollars) under both real and hypothetical conditions, for gains and losses.

II. Incentive Effects for Choices Involving Gains

Holt and Laury (2001) examined the effects of payoff magnitudes in an experiment where people were asked to choose between matched pairs of safe and risky lotteries. These pairs were arranged in a menu of the type shown in Table 1. In all rows, the payoffs are \$1.60 and \$2.00 for Option A, the safe lottery, and \$3.85 and \$0.10 for the Option B, the risky lottery. The probability of the higher payoff in each pair is 0.1 in the top row, and then increases by 0.1 in each subsequent choice. The choice in Decision 10, listed in the bottom row, is between a sure \$2.00 and a sure \$3.85.

Table 1. Menu of Lottery Choices

	Option A	Option B	Your Choice
Decision 1	\$2.00 with probability = 0.1 \$1.60 with probability = 0.9	\$3.85 with probability = 0.1 \$0.10 with probability = 0.9	
Decision 2	\$2.00with probability = 0.2 \$1.60 with probability = 0.8	\$3.85 with probability = 0.2 \$0.10 with probability = 0.8	
…	…	…	…
Decision 9	\$2.00 with probability = 0.9 \$1.60 with probability = 0.1	\$3.85 with probability = 0.9 \$0.10 with probability = 0.1	
Decision 10	\$2.00 with probability = 1.0	\$3.85 with probability = 1.0	

Earnings were determined on the basis of one decision, selected at random after all choices had been made. In total, 93 subjects made the choices in Table 1, followed by a hypothetical choice menu for payoffs scaled up by a factor of 20 (\$40 or \$32 for the safe option, and \$77 or \$2 for the risky option). After the hypothetical earnings were determined, these same subjects were given an identical payoff menu with a clear

statement that all earnings would be paid in cash. (See Holt and Laury, 2001, for complete procedural details and instructions.)

Figure 1 shows the results, with the Decision (1 through 10) on the horizontal axis and the percentage of safe choices shown on the vertical axis. The dashed black line represents the risk neutral choice pattern: choose safe with probability 1.0 in Decisions 1-4, then choose risky (0% safe choices) for all remaining decisions. More than four safe choices indicate risk aversion, and fewer safe choices indicate risk preference.

The colored lines show actual choice frequencies in each of our treatments, where real payoffs are shown with thick lines and hypothetical payoffs with thin lines. The percentages for the low payoff trial, the yellow line, generally lie to the right of the risk neutral prediction, indicating some risk aversion even for low payoffs. Choices under scaled up hypothetical payoffs (see the thin red line), are quite close to the 1x real line. It became apparent to us, however, that subjects were *not* able to predict how risk averse they would be when actually faced with these choices. The thick red line shows observed choices when these high payoffs were actually paid; it lies significantly to the right, indicating a greater degree of risk aversion.

We ran an additional 19 subjects through the same sequence, but with hypothetical and real payoffs scaled up by a factor of 50 (blue lines), and another group of 18 had payoffs scaled up by 90 (green lines). In the 90x payoff treatment, the safe lottery earned $180 or $144, and the risky lottery earned $346.50 or $9. It is clear from the thin lines in Figure 1, scaling up of hypothetical payoffs had little effect on choice frequencies. In contrast, the thick lines show that each successive increase in real payoffs resulted in higher risk aversion. In the 90x real condition, one-third of the subjects chose the safe option in Decisions 1-9, only switching on Decision 10 where the highest payoff was a certainty. The safe option in this condition ensured earnings of at least $144; this minimum was sufficiently attractive that a large fraction of people did not take *any* risk of receiving the low ($9) payoff from the risky lottery. A similar tendency to observe more risk aversion as payoffs are scaled up was reported by Binswanger (1980), who ran experiments with farmers in rural Bangladesh with some payoffs equivalent to the average monthly income.

These results indicate the danger of comparing low real payoffs with high hypothetical payoffs, and concluding that payoff effects may not be present (as has been done in some widely cited papers). They also suggest that high hypothetical payments may not yield good predictions of behavior under high real payoffs. The next section considers these issues when lottery choices involve losses.

III. Choices in the Loss Domain, and the Reflection Effect

In a second paper, Laury and Holt (2002) consider the effect of reflecting all payoffs around zero to obtain lotteries over losses. The choice menu was like that shown in Table 1, with two exceptions. The top row involved a sure thing (a probability of 0 for the higher payoff); as before, the probability of the high payoff increased by 0.1 in each successive row, so the probability of the high payoff was 0.9 in Decision 10. Also, the choices in the low-payoff gain treatment were twice the level shown in Table 1 ($4 or $3.20 for the safe option and $7.70 or $0.20 for the risky option). When these numbers were reflected, the payoffs were -$4 or -$3.20 for the safe option and -$7.70 or -$0.20 for the risky option. The structure of the menu was such that a risk-neutral person would choose exactly 5 safe choices, and a risk-averse person would choose more safe choices, whether the payoffs were in terms of gains or losses.

Each subject completed the menu of lottery choices for both gains and losses. Typically when losses are possible, subjects are given an initial stake by the experimenter. In these experiments, subjects first participated in another decision-making experiment during which they built up their initial stake. We hoped to minimize any "found money" effects by having subjects earn this money. After the initial experiment, subjects were given the menu of lottery choices, first for gains (losses), and then for losses (gains). The order in which gains and losses were presented was varied between sessions. Results from the first lottery choice treatment were not revealed until choices in the second treatment had been made. We separated the two lottery choice experiments by a neutral matching pennies experiment. See Laury and Holt (2002) for a complete description of the procedures.

Figure 2 shows the relationship between an individual's choices in the gain and loss conditions in our hypothetical payoff sessions (81 subjects). The blue bar in the back

right corner of the graph (labeled "Reflection") represents subjects who made choices consistent with risk aversion in the lottery over gains, and risk preference in the lottery over losses. This choice pattern is the well known "reflection effect," which is one component of Prospect Theory, as described by Kahneman and Tversky (1979) and Tversky and Kahneman (1992). Although the rate of reflection observed in our experiment (26 percent) is lower than that obtained in Kahneman and Tversky's pair-wise lotteries (with hypothetical payments), this is the modal choice pattern in these sessions. Figure 3 presents the same information when payoffs are real (76 subjects). The difference is dramatic. The rate of reflection (13 percent) is half that observed when hypothetical payments are used. Moreover, the modal choice pattern involves risk aversion under both gains and losses (29 percent). The rate of reflection is even lower when payoffs (real and hypothetical) are increased by a factor of 15 (to 30 times the levels shown in Table 1; earnings from the initial experiment were similarly increased). Only about 19 percent of subjects reflect under high hypothetical payoffs, compared with 9 percent of subjects who faced high real payoffs.

Considering the average number of safe choices made under gains and losses, subjects are less risk averse under losses, which is consistent with Prospect Theory's directional prediction. However, people tend to be risk averse for gains and approximately risk neutral for losses (not risk preferring for losses as Prospect Theory predicts), regardless of whether incentives are real or hypothetical, low or high.

Harbaugh, Krause, and Vesterlund (2001) similarly find that support for reflection depends on how the choice problem is presented. Specifically, they report that risk attitudes are consistent with Prospect Theory when subjects price gambles, but not when they choose between the gamble and its expected value. Others have found evidence of reflection when cash payments are used (Myagkov and Plott, 1997, Camerer, 1989, and Battalio, et al., 1990). However, taken together, these studies suggest that the degree of observed reflection may be context specific (for example, whether real payments are used, how the choice problem is presented, market context, and initial stake in the loss treatment).

IV. Conclusion

The use of monetary incentives may not affect behavior much in some contexts, or it may simply reduce the dispersion of data around some theoretical prediction. But our experiments indicate that incentive effects may be large and systematic in other contexts. In the absence of a widely accepted theory of when incentives matter, it is probably not advisable to derive scientific conclusions from laboratory studies that do not provide clear, salient motivation.

While hypothetical choice studies are not common in economics, and are rarely published in the top journals, this is not the case in other disciplines. Al Roth (1995, p. 86) comments that "the question of actual versus hypothetical choices has become one of the fault lines that have come to distinguish experiments published in the economics journals from those published in psychology journals." In a recent paper, Hertwig and Ortmann (2001) reviewed all papers published in the *Journal of Behavioral Decision Making* for a recent 10-year period. In 186 experimental studies, financial incentives were only used in 26% of those. In a second survey of about 100 papers on Bayesian inference tasks in a variety of psychology journals, only about 2-3 papers used financial incentives.

The evidence surveyed here shows that relying on hypothetical payments can yield misleading results in some circumstances. Moreover, social scientists do not have a good feel for when to believe hypothetical choice patterns. Given this, we believe that performance based incentives should be used in economics experiments, and results motivated by hypothetical incentives should be interpreted with caution.

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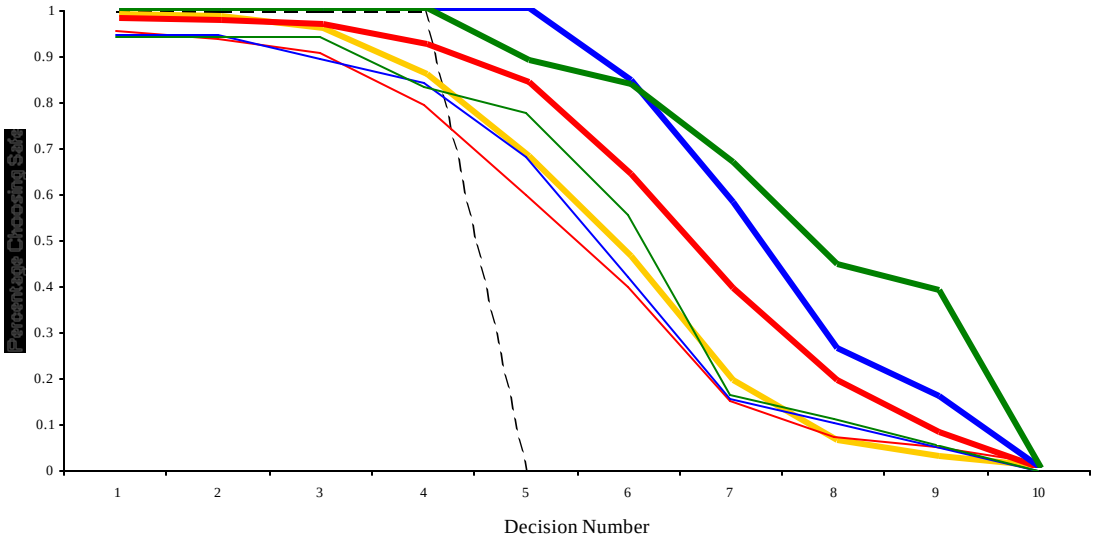
Figure 1. Percentage of Safe Choices Under Real and Hypothetical Conditions

(1x, 20x, 50x, and 90x Payoff Scale)



Key: Real Payoffs (thick lines), Hypothetical Payoffs (thin lines), Risk Neutral Precition (thin, dashed line)

Figure 2. Risk Aversion Categories for Losses and Gains (Hypothetical Payoffs)

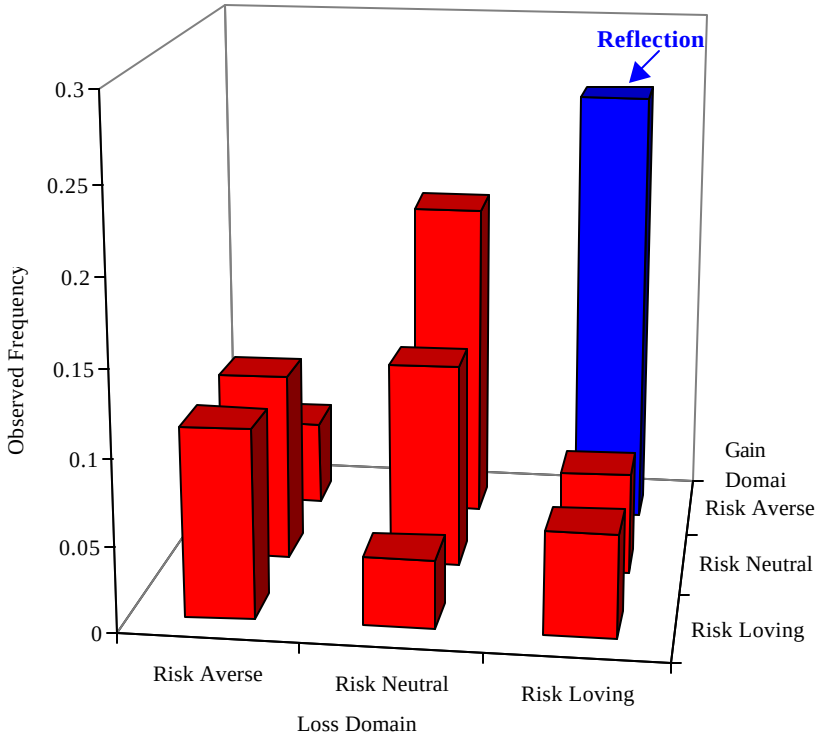


Figure 3. Risk Aversion Categories for Losses and Gains (Real Payoffs)