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ABSTRACT

Asset Integration, Risk Taking and Loss Aversion in the Laboratory

We report on a laboratory experiment testing for the presence of loss aversion, as separate from risk aversion, utilizing an asset integration protocol designed to ensure that a loss of cash provided by the experimenter is viewed as a real loss by experimental participants. Our experimental design augments the Holt-Laury risk preference elicitation methodology to assess how individuals choose between a safe option and a riskier lottery. When the money at stake is viewed as the individual's own money, one of the lottery outcomes is in the domain of losses. Our results confirm that individuals display an additional reluctance to participate in a mixed domain lottery beyond that predicted by risk aversion. We show that only preference functions incorporating loss aversion are able to generate predicted behaviour that matches our results.

JEL Classification: C91, D81

Keywords: risk taking, experiments

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1. Introduction

In this paper we report on a laboratory experiment designed to assess risk preferences in a decision environment where real losses can occur. Specifically, we use an *asset integration protocol* developed in Morrison and Oxoby (2013) combined with the well-known risk-preference elicitation framework of Holt and Laury (2002, 2005) to measure how aversion to risk is affected by a credible shift in outcome domains. Our goal is to be able to assess different preference function specifications; in particular rank dependent expected utility (RDEU) and prospect theory (PT) preferences. While these models share non-linear probability weighting, only PT accounts for the influence of loss aversion. In order to assess PT preferences in our experiment it is crucial that treatment group participants fully integrate the money received from the experimenter with their own wealth, thereby incorporating it into their reference point and allowing for the possibility of loss aversion.

In our two-session design (session 1 and session 2 are one week apart), the money to be placed at stake in our incentivized risk elicitation task is earned in session 1 by *all* participants (i.e. in both control and treatment groups). However our treatment group follows an additional asset integration protocol whereby they are paid their cash earnings in session 1 and return to the laboratory for session 2 (one week later), bringing with them an amount of cash equal to the amount they earned in session 1. It is this cash that is placed at stake in the incentivized decision task.

While many studies have employed designs wherein participants earn money rather than being given cash endowments (cf. Cherry et al, 2002, and Oxoby and Spraggon, 2013 in the domain of social preferences), our protocol demonstrates that this is not sufficient to achieve complete asset integration. Rather, at least in the context of Morrison and Oxoby (2013) and the current study, treatment group participants in individual choice experiments must retain money, thereby explicitly and physically integrating it with their own resources.

A key feature of our experimental results is that all treatment group participants returning for session 2 report that the cash they brought with them was not the same cash that had been paid to them a week earlier. This strongly suggests that the money they received from the experimenter was spent during the intervening week between sessions.

Consequently, the money placed at risk in our incentivized task was, in every sense, the participants' own money. This protocol, as demonstrated in Morrison and Oxoby (2013) and here, thus yields behavior that is consistent with complete integration of monies received in the experiment into own wealth.

Withiun this protocol, our results reject RDEU as providing an adequate predictor of observed behavior in our experiment and instead suggest the presence of loss aversion. This conclusion is bolstered by the fact that PT is consistent with our results.

Background

The descriptive inadequacy of expected utility theory (EUT) has been the subject of two distinct ongoing streams of theoretical research; namely RDEU theory and PT. RDEU theory (Quiggin, 1982; Prelec, 1998; Gonzalez and Wu, 1999) was introduced as a generalization of EUT that would improve predictive performance while preserving EUT's underlying structure. The central innovation of RDEU models is to incorporate probability weighting functions that allow it to capture two intuitive assumptions; (i) people care about how good or bad outcomes are and (ii) they process probabilities in a non-linear fashion (Diecidue and Wakker, 2001).

Under PT (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991; Kahneman, Knetsch and Thaler, 1991), in addition to probability weighting, individuals derive utility from gains and losses measured relative to a reference point. Furthermore, preferences exhibit diminishing sensitivity, meaning that individuals are risk averse over moderate probability gains but risk-seeking over moderate probability losses. Lastly, PT admits a role for loss aversion, whereby losses relative to a reference point are weighted more heavily than gains of equal magnitude (Barberis, 2013).

The asset integration protocol in our experiment influences the reference point of participants, falling in line with research exploring how reference points are determined under PT. For example, Koop and Johnson (2012) and Lehenkari (2012) have identified how individuals may use multiple reference points and that reference points may become particularly salient when outcomes involves self-justification.[1]

2. Asset Integration and the Decision Frame

To consider the role of asset integration, consider the following two decisions: Define Decision 1 as a choice between receiving \$20 (with certainty) or entering a lottery with a 70% chance of winning \$35 and a 30% chance of winning \$3.50. Since all outcomes are in the domain of gains and assuming identical probability weighting functions we can expect PT and RDEU theory to offer similar behavioral predictions (although PT and RDEU predictions may differ from those of EUT).

Now define Decision 2 as a choice between purchasing or not purchasing a \$20 lottery ticket using your own money, where the lottery is the same as in Decision 1 (i.e. a 70% chance of winning \$35 and a 30% chance of winning \$3.50). Faced with Decision 2, an individual is likely to recode the lottery prizes, taking the cost of the lottery ticket into account. That is, the individual will frame the decision as a choice between a 70% chance of winning \$15 (\$35-\$20) and a 30% chance of losing \$16.50 (\$3.50-\$20) versus no change in income. Framed this way, the lottery has mixed domains; one outcome in each of the domains of gains and losses. In Decision 2, the predictions of PT and RDEU may now diverge due to the presence or absence of loss aversion.

To generalize the analytics of decision making under uncertainty, consider a utility function over risky money prospects of the form

$$\begin{aligned} U^{+} &= p^{\alpha}.\left(\frac{m^{1-x}}{1-x}\right);\ \forall m \geq 0 \\ U^{-} &= \lambda.p^{\beta}.\left(\frac{m^{1-x}}{1-x}\right);\ \forall m < 0 \end{aligned} \qquad (1)$$

where p and m represent probability and money income. We can use this functional form to represent at least four distinct preference functions. For parameter values $\alpha = \beta = \lambda = 1$,

[1] Further research has explored the cognitive and neuropsychological underpinnings of this key aspect of PT (Trepel et al, 2005; Tom, et al, 2007).

eqn. (1) becomes a constant relative risk aversion (CRRA) preference function. For $\alpha = \beta \neq 1$ and $\lambda = 1$, the function represents RDEU preferences wherein probabilities are weighted non-linearly. For $\alpha = \beta = 1$ and $\lambda > 1$ we obtain a 'constant loss aversion' PT function (CLAPT) in which there is no probability weighting but where parameter λ represents a coefficient of constant loss aversion. Finally, for $\alpha \neq 1, \beta \neq 1, \ \alpha \neq \beta \ and \ \lambda = 1$, we obtain a probability-weighted PT function (PWPT) whereby the weights applied to objective probabilities are different in the domain of losses relative to the domain of gains.[2]

What choices do these different specifications of the utility function predict in the two decisions described above? In Decision 1, since both outcomes are in the domain of gains, the prediction of CLAPT is equivalent to that of CRRA. Similarly, given identical probability weighting parameter values, the prediction of PWPT is equivalent to RDEU. Thus, irrespective of the choice made in Decision 1, it is possible to find parameter values for all four functions that will predict observed behaviour. However, in Decision 2, the parameter values λ and β for CLAPT and PWPT will generate different predictions of an individual's choice relative to CRRA and RDEU.[3]

To link the above discussion to our experimental design, consider an experiment in which participants receive \$20 from the experimenter and are asked whether they wish to keep this money or enter a lottery with a 70% chance of winning \$35 dollars and a 30% chance of winning \$3.50. If the participants do not integrate the \$20 received from the experimenter into their own wealth, they are likely to perceive all outcomes as gains relative

[2] Our characterization of RD and PWPT preference functions makes use of a power function to represent probability weighting. As such these are simplified versions of a probability weighting function proposed by Prelec (1998) as: $w(p) = \exp\{-\delta(-\ln p)^{\gamma}\}$. Our specification is a special case of this function which reduces to $w(p) = p^{\delta}$ when $\gamma = 1$. Under this specification, probabilities are inflated when $\gamma < 1$ and deflated when $\gamma > 1$. Therefore, these probability weighting functions do not exhibit 'subproportionality'; i.e. they cannot take an inverse-S shape whereby lower probabilities are overestimated while higher probabilities are underestimated, which occurs for $0 < \gamma < 1$. Nevertheless our simplification does not inhibit the generality of later analysis and results. Alternate approaches to assessing these functions include Booij and van de Kuilen (2009).

[3] For example, suppose we observe an individual who chooses \$20 over the lottery in Decision 1. A CRRA function with $x = 0.8$ or an RDEU function with $x = 0.5, \ \alpha = 1.3$ will give rise to a utility of \$20 received with certainty that exceeds the expected utility of the lottery, which is thus consistent with the observed behaviour. Similarly, a CLAPT function with $x = 0.8$ and λ=2.2 or a PWPT function with $x = 0.5, \ \alpha = 1.3$ and $\beta = 0.4$ will also predict a choice consistent with the observed behaviour. Now, using the same parameter values as above, the CRRA and RDEU functions applied to Decision 2 will yield an expected value of purchasing the lottery that exceeds the expected value of not doing so. However, in the CLAPT and PWPT functions, the additional loss aversion parameters (λ and β) generate the opposite prediction.

to their original wealth. Consequently in the absence of asset integration, participants will frame the choice they are being asked to make as Decision 1. However, if participants fully integrate the $20 they have received as part of their own wealth, they are likely to regard giving up $20 as a real loss of their own money and will thus frame the choice as Decision 2.

3. 'House Money' Bias and Asset Integration Protocols

The problem of participants failing to integrate income from the experimenter with their own wealth is often referred to as 'house money' bias.[4] To control for 'house money' bias, several authors have employed protocols requiring participants to earn or hold on to financial resources for an extended period of time prior to completing the tasks of interest. Such studies include Bosch-Domenenech and Silvestre (2010), Rosenboim and Shavbit (2012), Morrison and Oxoby (2013) and Cardenas et al (2014).[5] In particular, Cardenas et al (2014) use this approach to test whether 'house money' bias effects risk aversion in a CRRA preference framework. They find that individuals who were endowed with money 21 days in advance of the experiment and who spent a portion of it (35% on average) prior to the experiment demonstrated greater reluctance to bear risk compared to those who had not spent any of the endowment. Cardenas et al (2014) argue that spending some portion of the cash advanced to them by the experimenter signals that a degree of asset integration has occurred. However they do not consider the predictive power of RDEU or PT preferences in relation to their results.

In a recent study, Harrison and Swarthout (2016) conduct a large series of experiments to test whether cumulative prospect theory (CPT) is a better predictor of decision-making compared to a number of risk preference functions, including CRRA and RDEU.[6] Their experimental design includes three classes of lottery prize domains: (i) all

[4] See for example Clark (2002), Harrison (2007), Spraggon and Oxoby (2009) and Oxoby and Spraggon (2013) who demonstrate how house money effects can influence decision-making in public goods experiments.

5 Other researchers have explored the ways in which house money effects and loss aversion can affect decision-making in experiments. For example, Cherry et al (2002) and Oxoby and Spraggon (2008) find that legitimizing assets significantly reduces contributions in a dictator game.

[6] See also Harrison et al. (2017)

prizes in the domain of gains, (ii) all prizes in the domain of losses, and (iii) mixed domain lotteries. While they find weak support for CPT, their overall conclusion is that RDEU is the best predictor of individual decision-making. To address house money bias, Harrison and Swarthout (2016) implement a procedure whereby some participants earn the money to be used in incentivized lottery choices. However a key finding in Morrison and Oxoby (2013) is that earning money in the laboratory does not yield decisions that are significantly different from those made with house money.

Morrison and Oxoby (2013) conduct an experiment to elicit intertemporal discount rates in which individuals are asked to choose between a sum of money to be paid immediately and a larger sum to be in paid three weeks. Control group participants were simply endowed with money while a first treatment group of participants earned money by completing a quiz (in a similar fashion to Harrison and Swarthout, 2016). A second treatment group also earned money by completing a quiz but were paid their earnings and told to return in one week's time to compete the incentivized intertemporal decision task using an amount of money equal to the amount they had earned. Morrison and Oxoby (2013) find a large and significant difference in the elicited discount rates of the second treatment group relative to the control group and first treatment group. However, they find no statistically significant difference in the elicited discount rates of the control group and the first treatment group, suggesting that (at least in the context of intertemporal decision making) earning money in the lab produces the same behaviour as being given the money.

In the experiment described below, we employ the Morrison and Oxoby (2013) asset integration protocol to ensure that outcomes in the incentivized task which fall within the domain of losses are coded as such by treatment group participants.

4. Experiment

The overall design and asset integration protocol for our experiments is presented in Figure 1 below.

FIGURE 1 ABOUT HERE

In all conditions, participants began by completing a twenty-question quiz consisting of questions from the Graduate Record Exam (GRE). Participants were informed that they would earn $20 if they correctly answered at least ten questions and $10 otherwise. This threshold was chosen (based on experience in previous experiments) to ensure participants earned $20 while requiring they exert significant effort in the exam.[7]

4.1 Control Groups

The control group for the experiment was divided into two sub-groups: Control Group 1 and Control Group 2. Participants in Control Group 1 completed all tasks in a single session and were paid in cash at the conclusion of the incentivized task, including a $5 show-up fee. Participants in Control Group 2 completed the same sequence of tasks as Control Group 1 (earning money, hypothetical risk elicitation, incentivized risk elicitation) but over two sessions. In session 1, Control Group 2 participants completed the quiz, were informed that they had earned $20 and then completed the hypothetical decision table. They were then asked to return in one week's time for session 2 in which they would be paid the earnings from the quiz and complete the incentivized task (they also received a $5 show-up fee at the conclusion of session 2). Thus, both control groups received their $20 earnings from the quiz immediately prior to completing the incentivized task, with the incentivized task being delayed one week for Control Group 2. The rationale behind splitting the control group in this way was to be sure that the one-week delay between sessions was not driving the behaviour of control or treatment group participants.

4.2 Treatment Group

In session 1, participants in the Treatment Group also earned their $20 via the GRE quiz and were paid $20 in cash immediately after completing a hypothetical decision table. They were then asked to return in one week's time for session 2 bringing $20 in cash with them for use in the incentivized decision task. Participants were told that they would have the opportunity to receive additional money in session 2 (through the incentivized risk elicitation task) and that they would receive a $5 show up fee at the end of the second

[7] All participants did sufficiently well on the quiz to earn $20.

session. Treatment Group participants thus had the $20 payment from the GRE quiz in their possession for one week, thereby enabling them to integrate money from the experimenter with their own wealth.

When Treatment Group participants returned for session 2, they were asked to put the $20 they brought with them into an envelope labeled with their participant ID. Envelopes were collected by the experimenter and Treatment Group participants were asked if the $20 cash they put in the envelope was the actual cash they had received a week earlier. As our focus is on creating a sense of ownership over the money, this question sought to identify if participants retained the actual cash from the first session or spent that money and brought their own funds to session 2. Treatment Group participants then completed the incentivized task and were paid in cash plus a $5 show-up fee.

Four elements in our experiment are common to all conditions: (i) earning money via the quiz, (ii) completing a hypothetical decision table, (iii) completing an incentivized task and (iv) answering two asset legitimacy questions. In regards to this last element, after completing the quiz and being informed that they would be paid $20, all participants were asked to indicate on a Likert scale ranging from 1 [strongly disagree] to 7 [strongly agree] whether they agreed with two asset legitimacy statements:

Statement 1: I am entitled to the money I received for participating in the experiment.
Statement 2: I earned the money I am receiving for participating in the experiment.

These statements were used to assess the extent to which participants believed they had legitimacy over the earned resources.

4.3 Elicitation of Risk Preferences

After answering the asset legitimacy questions, all participants completed a hypothetical, scaled-up version of a risk preference elicitation decision table from the original study by Holt and Laury (2002; Table 1).[8]

[8] See Holt and Laury (2002); Table 1, p1645 for the original decision table.

TABLE 1 ABOUT HERE

In this task, participants made choices between ten pairs of lotteries, where the first lottery (Option A) had a smaller spread relative to the second lottery (Option B). The defining feature of the Holt and Laury (2002) mechanism is that expected values in early decisions favor Option A while the expected values in later decisions favor Option B, thus providing a predicted 'cross-over point' for risk neutral individuals. Individuals whose cross-over point occurs at a later decision in the table are inferred to exhibit risk aversion. In their initial experiment, Holt and Laury (2002) find approximately two thirds of participants display risk-aversion, even over small dollar amounts. In Table 1, the expected value of Option A exceeds that of Option B in decisions 1-4 and falls below that of Option B in decisions 5-10. We utilized this hypothetical exercise to create a benchmark measure of risk preferences across all our treatments, completed at the same point in the order of tasks by all participants. This provides an indication of whether there are any fundamental differences in risk preferences across groups prior to the implementation of our protocols and completion of the incentivized task.

Our incentivized decision task (Table 2) also followed the Holt and Laury (2002, 2005) methodology by asking participants to make ten decisions between two options where Option A was defined as keeping the $20 earned earlier in the experiment and Option B was a lottery with two prizes ($35 and $3.50) with probability of receiving the higher cash amount increasing linearly with each decision.[9] In the incentivized task participants were told their payment for the experiment would be based on their response to a randomly selected decision from Table 2.

TABLE 2 ABOUT HERE

[9] The decision table for our incentivized task differs from the approach of Holt and Laury (2002, 2005) by having a certain amount of money rather than a lottery for Option A. Such decisions could illicit a preference for certainty over the risky option that would amplify measured risk aversion. Moreover as Vieider (2017) points out, increasing the probability of winning the top lottery prize in the decision table while maintaining a fixed certain dollar amount as the other option serves to make the certain option more salient which can also inflate the measured level of risk aversion. However, in our experiment we are interested in the treatment effect of asset integration, comparing the decisions of control and treatment groups who each complete the same incentivized decision table. That is, any amplifying effect on measured risk aversion as a result of having a certain cash outcome in the decision table is expected to exist for both the control and treatment groups.

5. Results

We recruited participants from the student population at a large Canadian university using the recruiting system by Greiner (2004). The experiments were conducted using the software developed by Fischbacher (2007).

Seventy-three individuals participated in the experiment, with 24, 18 and 31 participants in Control 1, Control 2 and Treatment groups. Power tests confirm that statistically significant effects identified in our data was not due to limited statistical power.[10] All participants expressed a high degree of ownership over the $20 they earned in the quiz, as represented by their responses to the asset legitimacy statements: mean scores (standard deviation) in the control and treatment conditions were 5.27 (0.79) and 5.42 (0.84) and we find no differences in the distribution of these responses across conditions (Wilcoxon $p>0.40$). All participants in the Treatment groups indicated that the $20 cash they brought to the second session was not the same cash they had received in the first session, suggesting the money they had earned had been spent in the intervening week.[11]

Table 3 compares the results for the two control groups with p-values indicating that we cannot reject the hypothesis that their decisions in both the hypothetical and incentivized tasks are drawn from the same distribution.[12]

TABLE 3 ABOUT HERE

Given we find no differences between Control Groups 1 and 2, we combine the data from both groups for the purposes of comparison with the Treatment Group. These results are summarized in Table 4 and illustrated in Figures 3 and 4.

TABLE 4 ABOUT HERE

[10] Using the effect sizes form similar studies (Morrison and Oxoby, 2013, Harrison and Swarthout, 2016) we conducted a two-tailed power test with $(1-\beta)=0.80$ and $\alpha=0.05$. On the basis of these means, a sample size of 16 participants per treatment was necessary.

[11] Participants were between the ages of 17 and 26 (average 20.8) and 55% were male. In an analysis of the data with respect to demographic information we found no gender or age differences (cf. Coller and Williams, 1999; McLeish and Oxoby, 2007). Three participants in the Treatment groups only participated in the first session, an attrition rate of 7.6%.

[12] For the null results with respect to the comparison of the Control 1 and Control 2 samples, between group effects yield $(1-\beta)=0.84$. , The null results between these two conditions are consistent with effect magnitudes in previous studies where asset integration was not considered (e.g. Morrison and Oxoby, 2013).

Figure 2 presents the percentage of participants choosing the safe option (Option A) in the hypothetical decision task for the control and treatment groups. While all participants displayed risk-aversion, we cannot reject the hypothesis that responses in the control and treatment conditions are drawn from the same distribution (Wilcoxon $p > 0.4$). In other words, all participants across all groups displayed similar risk preferences in the hypothetical decision task. [13]

FIGURES 2 AND 3 ABOUT HERE

However, as indicated in Table 4 and Figure 3, we find a striking difference in responses to the incentivized decision table and can reject the hypothesis that responses in the control and treatment conditions are drawn from the same distribution (Wilcoxon $p < 0.01$). That is, relative to the control condition, participants in our treatment condition were much less willing to give up $20 to participate in a lottery, even when the lottery offered a higher probability of receiving $35. This result is consistent with previous literature exploring loss aversion, asset legitimacy, and risky choice (e.g., Bosch-Domenenech and Silvestre, 2010, Rosenboim and Shavbit, 2012).

5.1 Discussion

Given our results, we now return to our aforementioned preference specifications (CRRA, CLAPT, RDEU, and PWPT) to consider which (if any) of these preference specifications can consistently predict the behavior exhibited by our control and treatment groups in both hypothetical and incentivized decision tasks. To do so, we must first consider whether the lottery presented to participants in the incentivized decision table is an 'all gains' lottery or a mixed domains lottery. Our results support the proposition that the Control Group viewed their incentivized decision table as containing choices between $20 and an 'all gains' lottery (prizes of $35 and $3.50) while the Treatment Group viewed their incentivized

[13] Considering our treatment and combined control groups, an ex-post power test on the basis of the current samples and the identified between-group effects yields $(1-\beta)=0.99$.

decision table as containing choices between no change in their current income ($0) and a mixed domain lottery (prizes of $15 and -$16.50).[14]

For each of the four candidate preference functions, we calculate the parameter values necessary to generate the utility of each option in a decision table such that the theoretically predicted cross-over point [i.e. the first decision where $U(Option\ \mathrm{B}) > U(Option\ A)$] matches our observed cross-over point in the experiment. For example, in our hypothetical decision table, we observed that the average cross-over points for the Control Group and Treatment Group were 5.79 and 5.29. Consequently, for each 'candidate' preference function, we can calculate the set of parameter values such that $U(Option\ \mathrm{B}) > U(Option\ A)$ for the first time at decision 6. Table 5 summarizes our calibration results for each preference function in conjunction with each decision table.

TABLE 5 ABOUT HERE

As indicated in Table 5, it is possible to identify ranges of parameter values for all four preference functions such that theoretical predictions regarding the cross-over points for the hypothetical decision table and the incentivized task completed by the control group are consistent with our observed cross-over points. However, as shown in the bottom two rows of the table, PT preferences are also able to generate predictions that are consistent with the behaviour of Treatment Group participants in their incentivized task.[15] Thus, while all four specifications are capable of explaining the observed when outcomes lie in the domain of gains, only CLAPT and PWPT are able to predict behaviour consistent with our results in the mixed domain decision environment.[16]

[14] Since all participants earned the money they received from the experimenter, one might consider the possibility that asset integration occurred for both Control and Treatment Groups, in which case the Control Group would also view their incentivized decision table as containing a mixed domain lottery. However, if this was the case, we should have observed no difference in the choices made by Control Group 2 and the Treatment Group in the incentivized task – a prediction that was contradicted by our results.

[15] The appendix (not intended for publication) provides an illustration using specific parameter values that lie within the ranges given in Table 5. Each set of diagrams show the theoretical utility values of each choice option for a decision table as generated by the four candidate preference functions with the implied cross-over point.

[16] As mentioned in an earlier footnote, our characterization of the RDEU and PWPT preference functions have probability weighting functions which are not subproportional, Nevertheless, the results of our

6. Conclusion

A key element of our experimental design has been the implementation of an asset integration protocol whereby Treatment Group participants took possession of money received from the experimenter for a period of one week before completing the incentivized task. Importantly, as a result this protocol, all Treatment Group participants in our experiment completed the incentivized task using their *own money* and thus faced the real possibility of losing this money if they accepted the lottery option in the decision table.[17] We view this as complete asset integration of the resources provided by the experimenter. The consequence was that Treatment Group participants displayed a significantly increased reluctance to bear risk in a lottery compared to the Control Group, driven by the possible loss of their own money rather than the riskiness of the prospect.

Our main results provide support for PT and the associated influence of loss aversion in decisions involving risk as expressed in Rabin (2000). From an experimental design perspective, our results suggest that experimenters should pay serious attention to the subtleties of asset integration especially when the experimenter wishes participants to experience possible or actual losses.

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calibration exercise are robust for weighting functions that do exhibit subproportionality. as outlined in Prelec (1998).

[17] This differs significantly from Cardenas et al (2014) where treatment group participants used (on average) 65% of the money provided by the experimenter to complete the incentivized tasks.

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Figures

FIGURE 1: EXPERIMENT DESIGN

	CONTROL GROUP 1	CONTROL GROUP 2	TREATMENT GROUP
SESSION 1	COMPLETE QUIZ – EARN $20 ↓ ASSET LEGITIMACY QUESTIONS * ↓ COMPLETE HYPOTHETICAL DECISION TABLE ↓ PAYMENT OF $20 ↓ COMPLETE INCENTIVIZED DECISION TABLE CONCLUSION AND FINAL PAYMENT (INCLUDING $5 SHOW-UP FEE)	COMPLETE QUIZ – EARN $20 ↓ ASSET LEGITIMACY QUESTIONS * ↓ COMPLETE HYPOTHETICAL DECISION TABLE ↓	COMPLETE QUIZ – EARN $20 ↓ ASSET LEGITIMACY QUESTIONS * ↓ COMPLETE HYPOTHETICAL DECISION TABLE ↓ PAYMENT OF $20 ↓
SESSION 2 (one week after Session 1)		PAYMENT OF $20 ↓ COMPLETE INCENTIVIZED DECISION TABLE ↓ CONCLUSION AND FINAL PAYMENT (INCLUDING $5 SHOW UP FEE)	PARTICIPANTS BRING $20 COMPLETE INCENTIVIZED DECISION TABLE ↓ CONCLUSION AND FINAL PAYMENT (INCLUDING $5 SHOW UP FEE)

FIGURE 2: PERCENTAGE OF PARTICIPANTS CHOOSING THE LESS RISKY OPTION IN HYPOTHETICAL DECISION TABLE

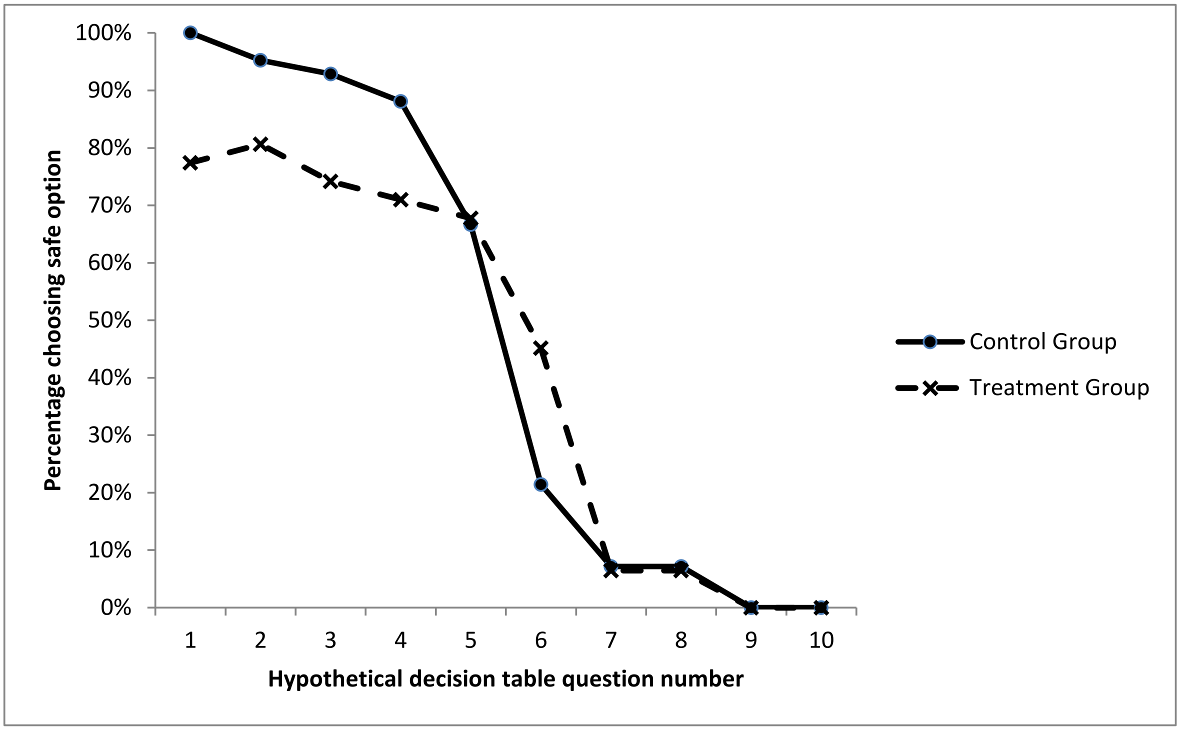
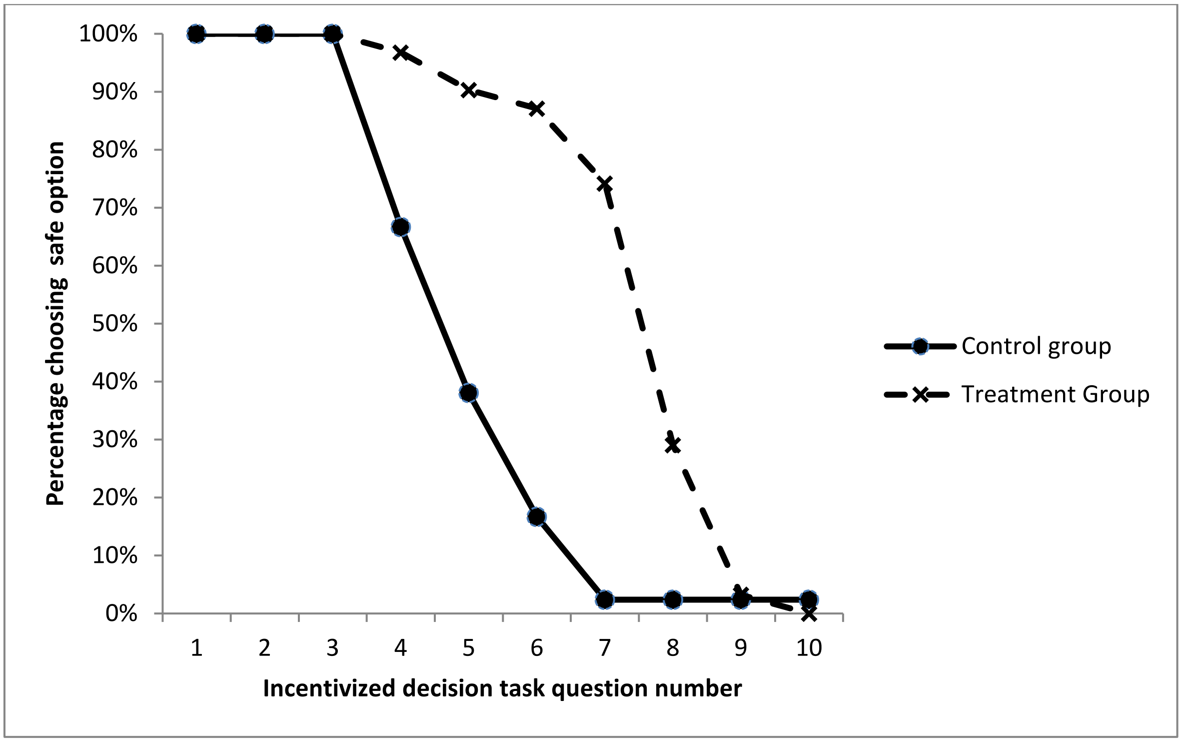


FIGURE 3: PERCENTAGE OF PARTICIPANTS CHOOSING THE SAFE OPTION IN INCENTIVIZED DECISION TABLE.



Tables

TABLE 1: HYPOTHETICAL SCALED-UP VERSION OF THE HOLT-LAURY (2002) DECISION TABLE.

Decision	Option A Details								Option B Details								Difference in expected values
1	A	10%	chance of	$200	and a	90%	chance of	$160	A	10%	chance of	$385	and a	90%	chance of	$10	$116.50
2	A	20%	chance of	$200	and a	80%	chance of	$160	A	20%	chance of	$385	and a	80%	chance of	$10	$83.00
3	A	30%	chance of	$200	and a	70%	chance of	$160	A	30%	chance of	$385	and a	70%	chance of	$10	$49.50
4	A	40%	chance of	$200	and a	60%	chance of	$160	A	40%	chance of	$385	and a	60%	chance of	$10	$16.00
5	A	50%	chance of	$200	and a	50%	chance of	$160	A	50%	chance of	$385	and a	50%	chance of	$10	-$17.50
6	A	60%	chance of	$200	and a	40%	chance of	$160	A	60%	chance of	$385	and a	40%	chance of	$10	-$51.00
7	A	70%	chance of	$200	and a	30%	chance of	$160	A	70%	chance of	$385	and a	30%	chance of	$10	-$84.50
8	A	80%	chance of	$200	and a	20%	chance of	$160	A	80%	chance of	$385	and a	20%	chance of	$10	-$118.00
9	A	90%	chance of	$200	and a	10%	chance of	$160	A	90%	chance of	$385	and a	10%	chance of	$10	-$151.50
10	A	100%	chance of	$200	and a	0%	chance of	$160	A	100%	chance of	$385	and a	0%	chance of	$10	-$185.00

TABLE 2: INCENTIVIZED DECISION TABLE

Decision	Option A	Option B								Option B Expected value	Difference in expected values
1	$20.00	A	0.1	chance of	$ 35	and a	0.9	chance of	$3.50	6.65	$13.35
2	$20.00	A	0.2	chance of	$ 35	and a	0.8	chance of	$3.50	9.80	$10.20
3	$20.00	A	0.3	chance of	$ 35	and a	0.7	chance of	$3.50	12.95	$7.05
4	$20.00	A	0.4	chance of	$ 35	and a	0.6	chance of	$3.50	16.10	$3.90
5	$20.00	A	0.5	chance of	$ 35	and a	0.5	chance of	$3.50	19.25	$0.75
6	$20.00	A	0.6	chance of	$ 35	and a	0.4	chance of	$3.50	22.40	-$2.40
7	$20.00	A	0.7	chance of	$ 35	and a	0.3	chance of	$3.50	25.55	-$5.55
8	$20.00	A	0.8	chance of	$ 35	and a	0.2	chance of	$3.50	28.70	-$8.70
9	$20.00	A	0.9	chance of	$ 35	and a	0.1	chance of	$3.50	31.85	-$11.85
10	$20.00	A	1.0	chance of	$ 35	and a	0.0	chance of	$3.50	35.00	-$15.00

TABLE 3: COMPARING CONTROL GROUPS

	Control Group 1	Control Group 2
Hypothetical decision average crossover point	5.63	6.00
Wilcoxon P values	$p > 0.5$	
Incentivized decision average crossover point	5.42	5.11
Wilcoxon P values	$p > 0.6$	

TABLE 4: COMPARING CONTROL AND TREATMENT GROUPS

	Hypothetical Holt-Laury Decision Task		Incentivized Decision Task	
Group	Control	Treatment	Control	Treatment
Average Crossover point	5.79	5.29	5.35	7.81
Wilcoxon P values	$p > 0.5$		$p < 0.01$	

TABLE 5: PREFERENCE FUNCTION CALIBRATION

		Preference Functions			
Decision Table	Cross-over point	**CRRA** $x \in [0.16, 0.32]$	**RDEU** $x \in [0.16, 0.36]$ $\alpha \in [0.81, 0.99]$	**CLAPT** $x \in [0.16, 0.32]$ $\lambda^- \in [2.2, 3.7]$	**PWPT** $x \in [0.16, 0.36]$ $\alpha \in [0.81, 0.99]$ $\beta \in [0.16, 0.35]$
		Cross-over Point			
Hypothetical: Control Group	Predicted	5.5	5.5	5.5	5.5
	Observed	5.6			
Hypothetical: Treatment Group	Observed	5.3			
Incentivized: Control Group (Domain of gains)	Predicted	5.5	5.5	5.5	5.5
	Observed	5.4			
Incentivized: Treatment Group (Mixed domains)	Predicted	5.5	5.5	7.5	7.5
	Observed	7.8			

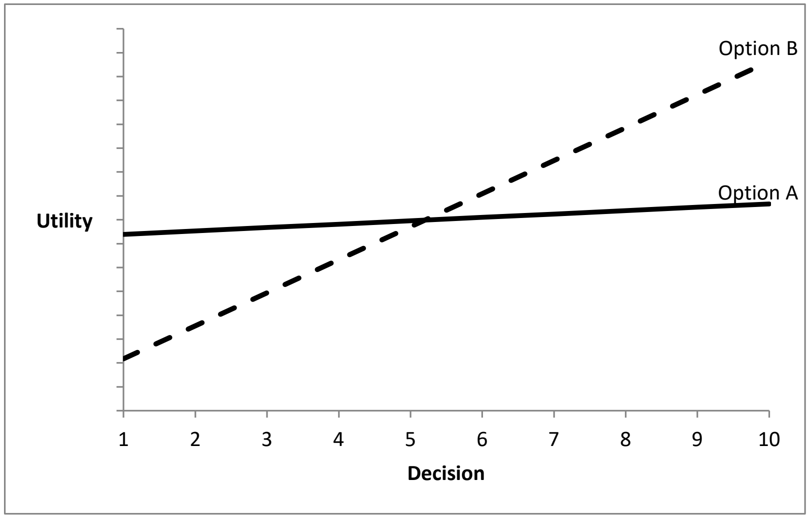
The figures below provide an illustrative example of the utility values generated by our four candidate preference functions for each of the decision tables in our experiment. The utility values are determined by assuming specific parameter values for each preference function all of which fall within the ranges stated in Table 5.

Figures A1 and A2 indicate that for the specific stated parameters all four preference functions yield utility values that predict the switch over point to occur between decision 5 and decision 6 for the hypothetical decision table and the incentivized decision table, conditional upon both lottery outcomes in the incentivized decision table being in the domain of gains.

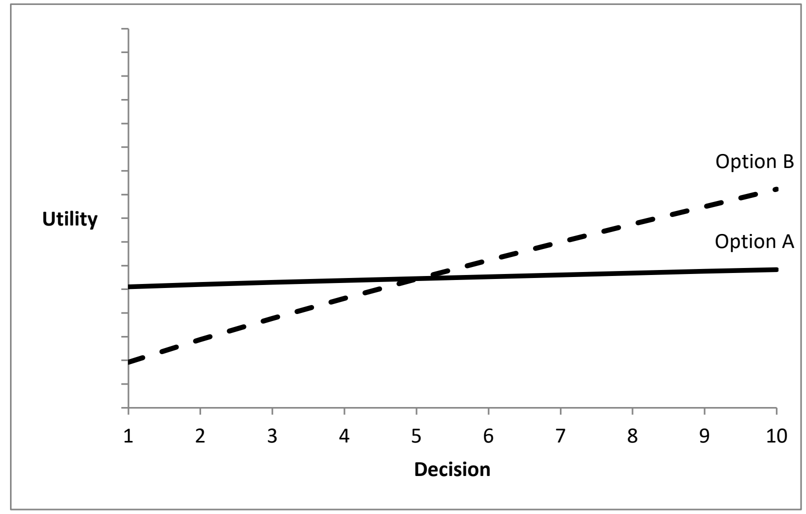
Figure A3 shows that for the stated parameter values the preference functions yield different predictions of the cross over point in the incentivized decision table when the lottery has mixed domains. Specifically, the CRRA function continues to predict the cross over between decisions 5 and 6, while the RD function predicts an earlier crossover between decisions 4 and 5. Both the loss aversion functions (CLA and PWLA) predict a significantly later cross over point between decisions 7 and 8.

APPENDIX (not intended for publication)

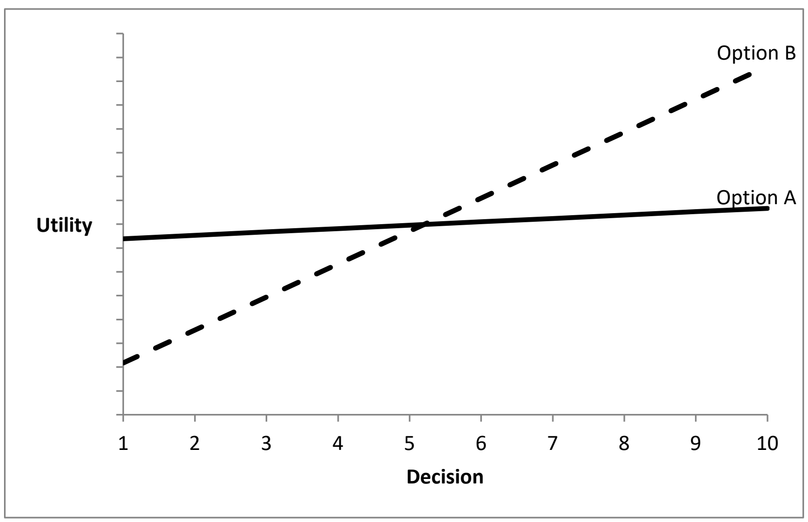
Figure A1: Utility values of candidate preference functions - hypothetical decision table:
choice between Option A (lottery outcomes: \$200 or \$160) and Option B (lottery outcomes: \$385 or \$10)



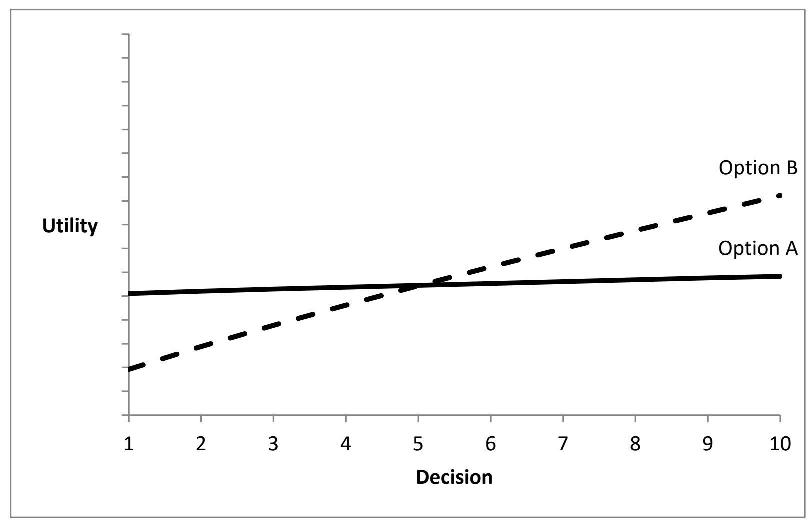
CRRA : $x = 0.2$



RDEU : $x = 0.3;\ \alpha = 0.85$

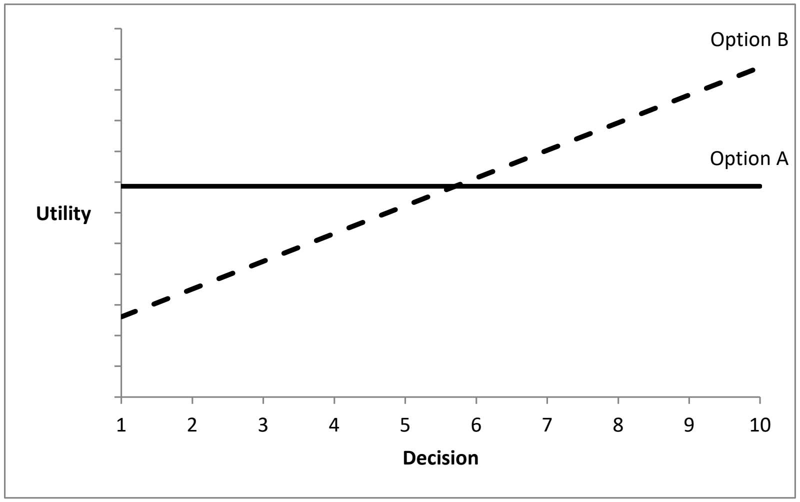


CLAPT : $x = 0.2;\ \lambda = 2.2$

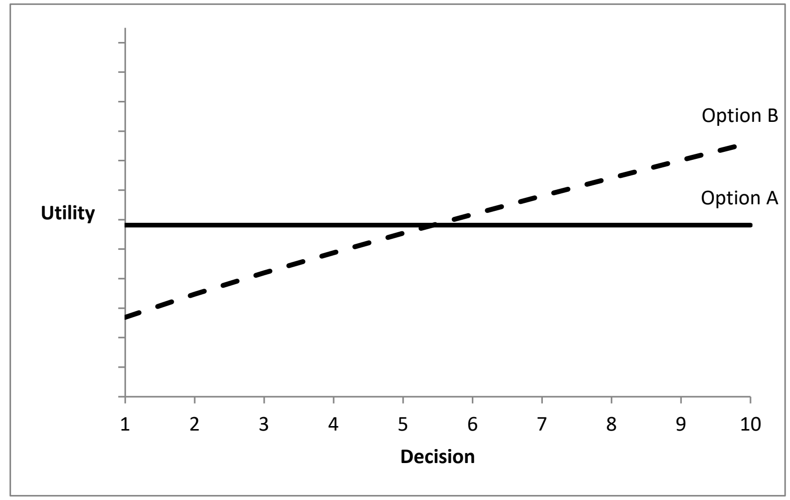


PWPT : $x = 0.3;\ \alpha = 0.85;\ \beta = 0.25$

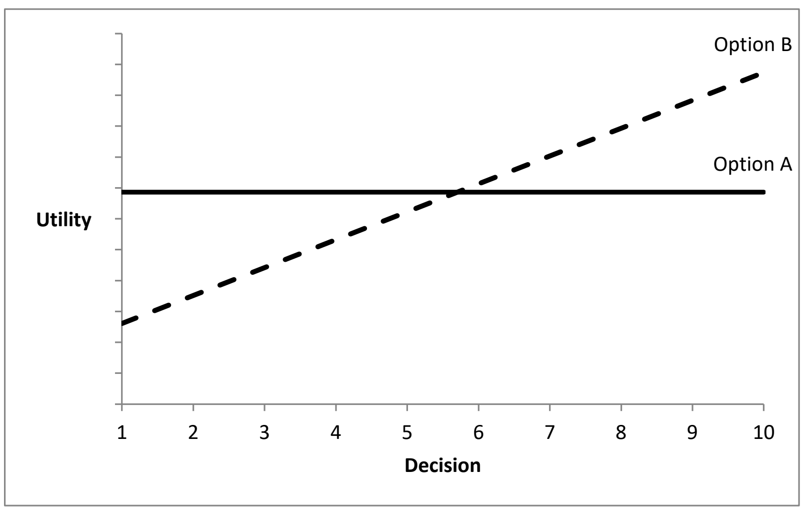
Figure A2: Utility values of alternative preference functions - incentivized decision task (domain of gains): choice between Option A ($20) and Option B (lottery outcomes: $35 or $3.50)



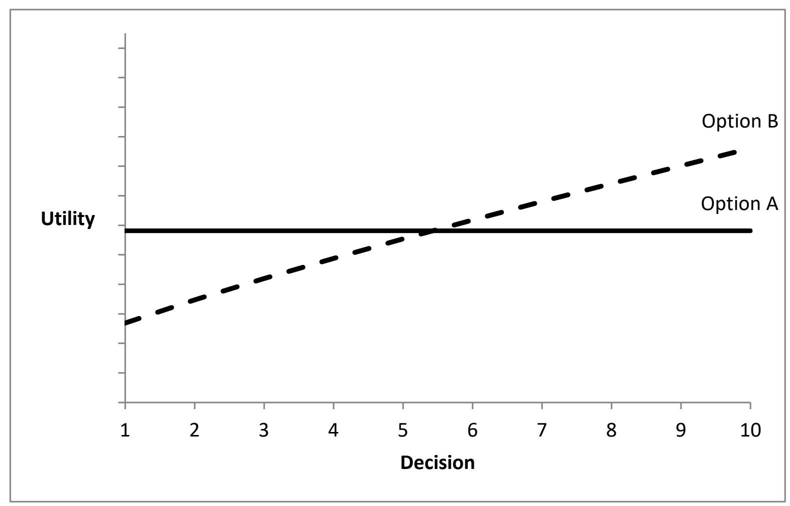
CRRA : $x = 0.2$



RDEU : $x = 0.3;\ \alpha = 0.85$

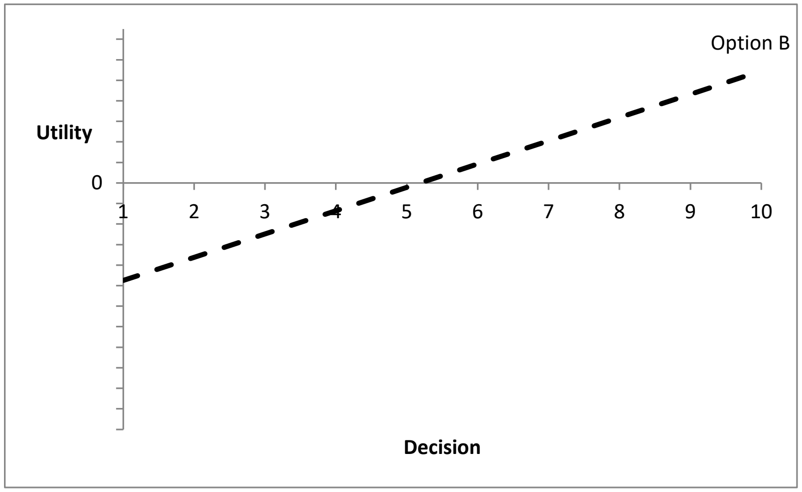


CLAPT : $x = 0.2;\ \lambda = 2.2$

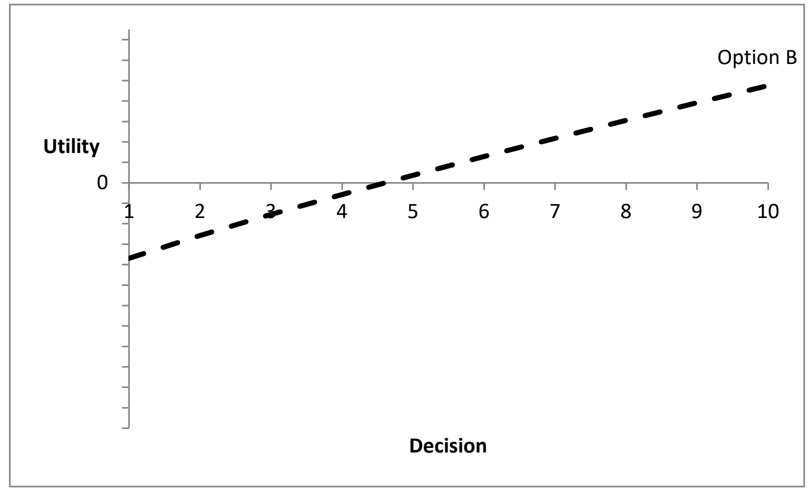


PWPT : $x = 0.3;\ \alpha = 0.85;\ \beta = 0.25$

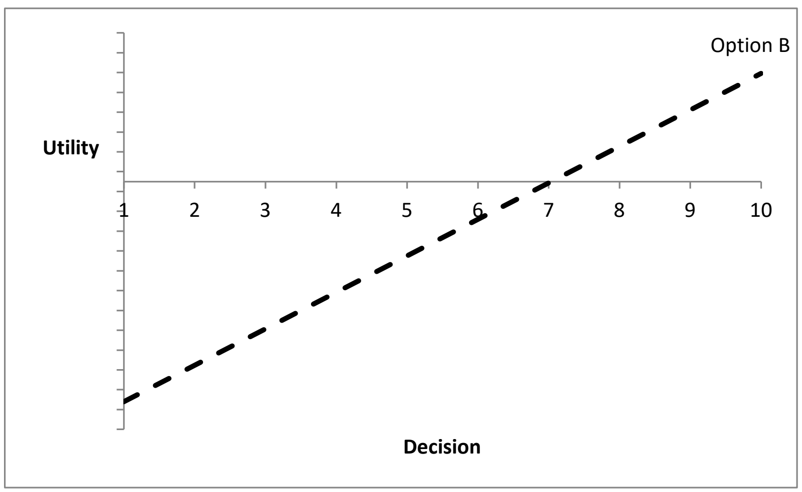
Figure A3: Utility values of alternative preference functions - incentivized decision task (mixed domain): choice between Option A ($0) and Option B (lottery outcomes: $15 or -$16.50)



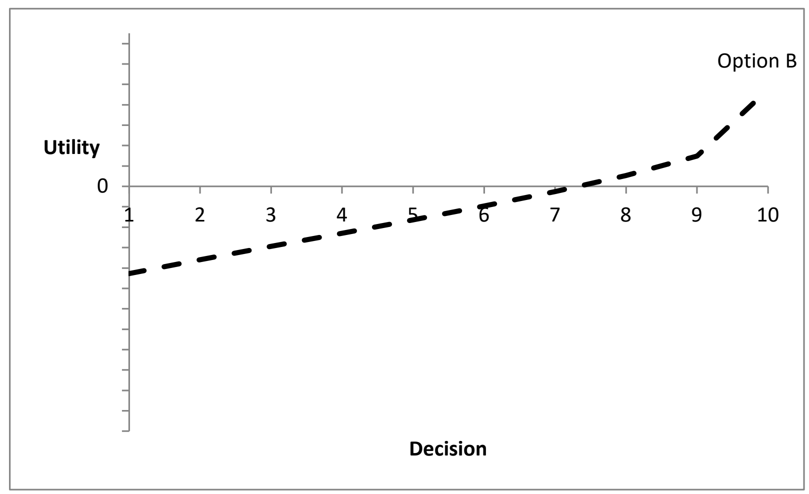
CRRA : $x = 0.2$



RDEU : $x = 0.3;\ \alpha = 0.85$



CLAPT : $x = 0.2;\ \lambda = 2.2$



PWPT : $x = 0.3;\ \alpha = 0.85;\ \beta = 0.25$