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How Certain Is the Uncertainty Effect?*

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Abstract

We replicate three pricing tasks of Gneezy, List and Wu (2006) for which they document the so-called *uncertainty effect*, namely, that people value a binary lottery over non-monetary outcomes less than other people value the lottery's worse outcome. While the authors implemented a verbal lottery description, we use a physical lottery format which makes misinterpretation of the lottery structure highly unlikely. We also provide subjects with complete information about the goods they are to value (book gift certificates and one-year deferred payments). Contrary to Gneezy et al. (2006), we observe for all three pricing tasks that subjects' willingness to pay for the lottery is significantly higher than other subjects' willingness to pay for the lottery's worse outcome.

Abstrakt

V této studii replikujeme tři experimenty, ve kterých Gneezy, List a Wu (2006) ukazují takzvaný vliv nejistoty, totiž že účastníci oceňují binární loterii s nepeněžními výsledky méně, než jiní účastníci oceňují nejhorší výsledek dané loterie. Narozdíl od těchto autorů, kteří popsali strukturu loterie pouze slovně, používáme fyzický formát loterie, kterým se stává špatné pochopení loterie vysoce nepravděpodobným. Navíc účastníkům podáváme kompletní informace o oceňovaných statcích (knižních dárkových poukazech a rok odložených platbách). Narozdíl od výše zmíněných autorů shledáváme ve všech třech experimentech, že účastníci oceňují loterii významně výše, než jiní účastnící oceňují nejhorší výsledek dané loterie.

Keywords: Decision under risk, framing, experiments, task ambiguity

JEL classification: C81; C91; C93; D83

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1. Introduction

Most theories of decision under risk require that the value of any risky prospect lie between the value of the prospect's best and worst outcomes. Gneezy, List and Wu (2006, henceforth GLW) term this requirement the *internality axiom* (henceforth IA) and document its systematic violations.[1] For various valuation goods (book gift certificates, one-year deferred payments, work effort, and sports cards), elicitation modes (pricing and choice), and implementation variants (hypothetical and real-stakes, laboratory and field experiments), GLW demonstrate that people value binary lotteries with intermediate probability mixes *less* than other people value the lotteries' worse outcomes.

GLW propose that IA violation is caused by what they call the *uncertainty effect*, attributable to two lottery design features that obstruct the IA. First, the lotteries involve non-monetary outcomes, the valuation of which may induce higher cognitive demands or perception of uncertainty. Second, the between-subjects design does not prompt subjects to value the lotteries based on valuing their outcomes. GLW argue that these two design features jointly trigger a "risk and return" lottery valuation process incompatible with most theories of decision under risk: Rather than valuing the lottery outcomes, subjects are hypothesized to value the expectation of the outcomes' face values and subsequently discount it for the risk involved in the lottery. This valuation process can indeed explain the observed IA violation if a high risk premium is levied on the lotteries with intermediate probability mixes.[2]

Our study of the *uncertainty effect* has two stages. In an initial study (reported fully in Ortmann et al. 2007), we examine whether GLW's experimental instructions – using a verbal and possibly ambiguous lottery description – could have contributed to IA violation that these authors report. For hypothetical pricing of book gift certificates, we show that rewording GLW's lottery instructions increases the lottery's valuation to an extent that

[1] In their footnote 1, GLW discuss theories of decision under risk that in principle permit IA violation. While the IA is seemingly derived from deterministic theories, its empirical tests have implications for stochastic theories as well.

[2] GLW in fact always observe IA violation for equiprobable binary lotteries, except for the hypothetical pricing of gift certificates where IA violation also occurs for lotteries with the probability mixes of (0.6,0.4) and (0.4,0.6).

essentially eliminates the possibility of IA violation. Nevertheless, our initial study still uses a verbal lottery description, which could in principle lead to misinterpretation. Sharing our concerns with GLW's lottery instructions, Keren and Willemsen (2008) demonstrate that verbally describing the same lottery in terms of a coin flip or a spinner wheel helps alleviate IA violation, though some subjects still fail a lottery comprehension test.

Our main, more extensive study aims to further enhance the transparency of GLW's tasks, while retaining the design features that the authors regard as essential for observing the *uncertainty effect*. We systematically replicate three of GLW's tasks involving hypothetical and real-stakes pricing of gift certificates and hypothetical pricing of deferred payments. Unlike the authors of previous studies, we implement a "physical" lottery format. Using equiprobable binary lotteries, we elicit subjects' willingness to pay for the opportunity of drawing a good (a gift certificate or a deferred payment form) from a closed bag containing two goods which are identical except for their face value. This lottery structure is physically demonstrated by the experimenter while reading aloud the instructions, which arguably rules out any misinterpretation. Furthermore, unlike previous studies except for Sonsino's (2008) web-based experiment, we provide subjects with complete information about the goods they are to value.

Following GLW, we use a between-subjects design. GLW document previous as well as their own results suggesting that neither between-subjects design nor non-monetary outcomes can separately induce IA violation. As detailed in the next section, however, Sonsino (2008) documents some (relatively minor) IA violation even in a within-subjects design, despite making the IA principle transparent to subjects.

We find no evidence for the *uncertainty effect*. Contrary to GLW, and in line with the IA, we observe for all three pricing tasks that subjects' willingness to pay for the lotteries is significantly higher than other subjects' willingness to pay for the lotteries' worse outcomes. In the next section, we outline our design and implementation and relate them to other studies that have, in various forms, replicated GLW's experiment. Section 3 presents the results, paying special attention to the between-subjects nature of the data. The concluding section discusses which implementation differences most likely lie behind the systematic discrepancy between our and GLW's findings.

2. Design and implementation

2.1 The valuation tasks and lottery implementation

We study three pricing tasks for which GLW document IA violation: hypothetical pricing of book gift certificates, real-stakes pricing of book gift certificates, and hypothetical pricing of one-year deferred payments. For each task, we run a *lottery treatment* eliciting subjects' willingness to pay for an equiprobable binary lottery featuring two gift certificates (deferred payments) with a face value of x and $2x$, and a *baseline treatment* eliciting other subjects' willingness to pay for the worse gift certificate (deferred payment) with a face value of x. Hence the IA is violated whenever the lottery-baseline between-subjects treatment effect is negative.[3] In several instances, we in fact run more than one lottery or baseline treatment for a given task, as will become clear from the following description and from the design matrix in Table 1. Experimental instructions for the various treatments are included in the Appendix.

Our initial study is motivated by our conjecture that GLW's lottery instructions – by describing the lottery purely verbally and by making a conceptual divide between the to-be-valued lottery ticket and the lottery outcomes – might have led to misinterpretation of the lottery structure. For the hypothetical pricing of gift certificates, we first conduct a lottery treatment T1 using GLW's instructions. In another lottery treatment T2, we reword GLW's lottery instructions in a way that assigns the lottery probabilities directly to the gift certificates' face values. We use gift certificates for the Luxor Book Palace (Neoluxor), which is one of the largest bookstores in the Czech Republic located within walking distance of the experimental site. As in GLW, the gift certificates are valid for the next two weeks.

To preview the results, the rewording of GLW's lottery instructions in T2 is associated with a strong upward shift in lottery valuations compared to T1. More importantly, the rewording essentially eliminates IA violation since 84% of lottery valuations in T2 are at or above the face value of the worse gift certificate. Nevertheless, we admittedly cannot exclude the possibility that our rewording induces other types of misinterpretation of the lottery. To tackle this issue, our main study uses a physical lottery format which – even

[3] Our design does not address the possibility that lotteries are valued *more* than their best outcomes, though Sonsino (2008) demonstrates this can happen in very rare cases (in 0.75% of observations).

without explicitly mentioning the lottery at all – makes lottery misrepresentation highly unlikely.[4]

The following physical format is implemented in all lottery treatments of our main study (i.e., in all treatments in the middle row of Table 1 except for T1 and T2). While reading the lottery instructions aloud, the experimenter presents a bag into which he places the two gift certificates (or deferred payment forms) and demonstrates how one certificate (form) is to be randomly drawn from the closed bag. The instructions explain that the two certificates (forms) are identical except for their value – which is also apparent to subjects when inspecting the circulated certificates (forms) as explained right below – and thus the chances of drawing either the better or the worse certificate (form) are equal. Subjects are then asked to state their willingness to pay for the opportunity of drawing one gift certificate (deferred payment form) from the bag.[5]

Our main study also uses gift certificates for the Luxor Book Palace (Neoluxor), but we now provide subjects with more information about the certificates. The instructions explain that the certificates are valid for the next three months and enable in-store and online purchase of books (including CD and DVD formats), maps, stationery, etc.[6] In all gift certificates treatments (T3-T8), the experimenter circulates among subjects several gift certificates of the appropriate face value in order to ensure common knowledge and enhance credibility. While reading the instructions aloud, the experimenter also mentions other conditions of use of the certificates, such as the characteristic that no cash is returned if one's purchase falls below the certificates' face value.

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[4] Using a physical lottery format to study sources of risky decision anomalies is of course nothing novel and goes back a long way. See, for instance, Grether and Plott (1979, Section II) where a physical lottery demonstration does not help alleviate preference reversals, and Gigerenzer et al. (1988, Experiment 1) where a physical demonstration of random sampling lessens base rate neglect significantly.

[5] For the real-stakes pricing of gift certificates, we were unable to obtain gift certificates worth $2x$, so we used two identical table tennis balls marked x and $2x$ to represent the real gift certificates. Subjects were informed that if they would draw a ball marked $2x$, they would receive two gift certificates worth x.

[6] The three-month validity of the gift certificates is longer than the two-week validity in GLW, our initial study, and Keren and Willemsen (2008). The discrepancy is not our choice but rather due to the bookstore's current policy. For completeness, Sonsino's (2008) gift certificates were valid 6 months.

In the hypothetical pricing of deferred payments, we use hypothetical payment forms guaranteeing cash payment one year from the date of the experiment. The instructions explain that the deferred payment would (in a real-stakes scenario) be guaranteed by the research organization that finances the experiment. In all deferred payments treatments (TP3-TP8), we again circulate several (hypothetically filled out) payment forms of the research organization for subjects' inspection. While reading the instructions aloud, the experimenter also mentions that the deferred cash payment would (in a real-stakes scenario) be made by one of the experimenters at the experimental site.

In the hypothetical pricing of gift certificates, x=500CZK (about $25), roughly matching the (student) purchasing power of x=$50 used in GLW. In the hypothetical pricing of deferred payments, we again use x=500CZK to make the two hypothetical pricing tasks comparable (GLW used x=$100). In the real-stakes pricing of gift certificates, x=200CZK (about $10) and all subjects' decisions are played out, while GLW used x=$50 and played out the decisions of 5% (1 in 20) of the subjects. Note that x=200CZK is still a substantial amount of money: it would be sufficient to purchase just under half of all books and textbooks and a much larger proportion of stationery items currently sold at the Neoluxor online shop (and the certificates can of course co-finance purchases exceeding their face value).

We next relate our design and implementation to other studies of the *uncertainty effect*. In a replication of GLW's hypothetical pricing of gift certificates, Keren and Willemsen (2008) find that when the equiprobable binary lottery is described in terms of a coin flip or a spinner wheel (though only verbally), no IA violation occurs, whereas when the lottery structure is described purely verbally though explicitly, the IA is violated.[7] Furthermore, a considerably higher proportion of subjects pass a lottery comprehension test in the former implementation (69-87%) compared to the latter implementation (29-43%). In general, IA violation seems to occur only for the group of subjects who fail the lottery comprehension test. While these findings are illuminating, one should note that GLW also use a (verbally described) coin-flip lottery implementation in their real-stakes gift certificates tasks but still observe IA violation. Also, Keren and Willemsen's lottery description retains the lottery

[7] The latter result is also observed by Simonsohn (2008), who implements the hypothetical pricing of gift certificates with an explicitly worded lottery as part of a series of surveys and experiments.

ticket (or lottery participation) terminology and the lottery itself is not demonstrated to subjects physically, which could be a reason why the proportion of subjects failing the lottery comprehension test is non-negligible.

In another related but *within*-subjects study, Sonsino (2008) runs a web-based experiment where subjects first value three gift certificates with widely different (undisclosed) market prices, featuring a luxurious weekend vacation, a gourmand dinner, and a choice between a fine bottle of wine and a box of gourmet chocolate. Subjects then value binary lotteries featuring pairs of the certificates while observing their own previous valuations of the certificates themselves. The valuations are elicited using a sequence of six-bidder Vickrey auctions (the probability of an auction being played out is about 5%). The lotteries (involving various probability mixes) are described verbally using the lottery ticket terminology and pie charts. Subjects are invited to ex-post participate in the actual lottery draw, where lottery outcomes are determined by volunteer subjects secretly choosing numbers which are then compared to randomly generated numbers.

To the best of our knowledge, Sonsino (2008) is the first study to demonstrate that IA violation can occur in a within-subjects design. In almost 12% of cases, subjects value a lottery less than they value either of the lottery's outcomes, and 27% of subjects do so at least once. IA violation gets more frequent as the probability of winning the lotteries' better outcomes decreases, contrary to GLW where IA violation occurs only for lotteries with intermediate probability mixes. One may only speculate about the reasons behind these results, including the web-based nature of Sonsino's experiment (potentially leading to loss of control), the auction-based elicitation mechanism, the lotteries featuring different goods (rather than goods that are identical except for their face value), and the sequential nature of the valuations possibly generating valuation order effects. Besides these potential reasons, it is once again possible that the verbal (though explicit) lottery description – involving the lottery ticket terminology and a rather lengthy explanation of the lottery draw – was misinterpreted by some subjects and contributed to what Sonsino calls "lottery aversion."[8]

[8] Sonsino (2008) argues that IA violation could be triggered solely by subjects' aversion to the presented lotteries *per se*. In the author's post-experimental questionnaire, "aversion to lotteries" is the most frequently chosen explanation for IA violation. Subjects were shown an example of within-subjects IA violation and, if admitting to the (hypothetical) possibility of exhibiting such behavior, were prompted to choose their favorite

2.2 Eliciting willingness to pay (WTP)

In the hypothetical pricing of gift certificates and deferred payments, we follow GLW in that the instructions simply ask subjects to state the highest price they would be willing to pay. One can of course imagine a procedurally more incentive-compatible mechanism for the hypothetical WTP elicitation, such as a hypothetical-stakes version of the elicitation mechanism we use for the real-stakes pricing task. However, for the sake of replication, we wished to retain the key features of GLW's hypothetical-stakes design for which the authors document IA violation. We hope – as implicitly did the authors of the previous hypothetical studies of the *uncertainty effect* – that the (potential) hypothetical bias does not interact with the lottery and baseline treatments in a way that biases the treatment effect towards or away from IA violation.

In the real-stakes pricing of gift certificates, we use the multiple price list (MPL) mechanism for eliciting WTP. In the lottery and baseline treatments T5 and T7, respectively, subjects receive $2x$ for participating. They are asked to indicate (by circling either Yes or No) their willingness to pay various prices listed in the MPL, where the prices range from $0.1x$ to $2x$ and rise in $0.1x$ increments. Subjects know that only one of their 20 decisions is payoff-relevant: after making all 20 decisions, each subject randomly draws a card from a box with cards numbered 1 to 20 to determine her payoff-relevant row. If she circled Yes in that row, she pays the price and gets the gift certificate worth x (in T7) or randomly draws a certificate from a bag containing two certificates worth x and $2x$ (in T5). If she circled No in the payoff-relevant row, she earns the participation fee.

We also run a supplementary baseline treatment T8 with a narrower MPL price range of $0.1x$ to x; hence the participation fee is x and subjects make only 10 Yes-or-No decisions. This would normally be a standard MPL procedure for valuing the gift certificate worth x, but we wish to guard ourselves against the possibility of a "mid-table" effect: A potential caveat of the MPL method is that subjects may be naturally drawn towards the middle of the MPL. Thus if the lottery treatment T5 with the wide price range were only compared with the baseline treatment T8 with the narrow price range, the mid-table effect could work against the occurrence of IA violation. We circumvent this problem by implementing the

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explanation for the behavior from a list of three options, the other two being "noise distraction" and "other explanations."

lottery and baseline treatments T5 and T7, respectively, with the same (wide) price range. In addition, comparing WTP valuations in T7 and T8 allows us to assess whether the mid-table effect is actually present in the baseline treatments.

To further guard ourselves against the possibility that the mid-table effect works against the occurrence of IA violation, we conduct a supplementary lottery treatment T6 where, similar to Andersen et al. (2007) and Harrison et al. (2007), the MPL is asymmetric: it is "skewed low" in the sense that the mid-row price is well below the mean of the MPL (in fact below 0.8x). If the mid-table effect is indeed present, the asymmetric MPL should (*ceteris paribus*) induce lower WTP valuations and hence favor the occurrence of IA violation. Furthermore, since the asymmetric MPL in T6 shares all prices up to 1.4x with the symmetric MPL in T5, we can directly compare WTP valuations in T5 and T6 to see whether the mid-table effect is actually present in the lottery treatments (in the price region up to 1.4x where most lottery valuations can be expected to fall).

In sum, to give IA violation a fair chance to occur in our data, we run the baseline treatment T7 with the wide MPL price range and the lottery treatment T6 with the asymmetric MPL, both of which favor the occurrence of IA violation if the mid-table effect is indeed present. While one can think of other behavioral effects being induced by our variation of the lottery and baseline treatments, such as changing the effective power of financial incentives, we cannot find a reason why any such effect should work against the occurrence of IA violation.

GLW used the Becker-DeGroot-Marschak (BDM) mechanism to elicit real-stakes WTP. We use the MPL elicitation mechanism as an alternative incentive-compatible elicitation mechanism. We do not wish to contrast the potential advantages and disadvantages of the MPL and BDM elicitation mechanisms. Our main goal is to assess the *direction* of the lottery-baseline treatment effect (i.e., the occurrence of IA violation or lack thereof) rather than obtaining WTP point estimates. Any incentive-compatible elicitation mechanism should serve that goal, *unless* the mechanism interacts with the lottery and baseline treatments in a way that biases the treatment effect towards or away from IA violation. In this respect, given the well-known concerns with the BDM mechanism (e.g., Karni and Safra 1987; Harrison 1992; Horowitz 2006), and having explicitly accounted for the mid-table effect that potentially induces treatment interactions when using the MPL mechanism, we feel more confident using the MPL mechanism to study the lottery-baseline treatment effect.

There are of course refinements of the basic MPL procedure which, for example, allow subjects to express indifference in their WTP, or elicit more precise WTP valuations by iteratively decreasing the MPL price increments (e.g., Andersen et al. 2007). Once again, however, given our focus on the direction of the lottery-baseline treatment effect rather than on WTP point estimates, the benefits of such refinements in our view do not outweigh their potential costs associated with increased complexity of the elicitation procedure. Our MPL price increments of $0.1x$=20CZK (about $1) seem fine enough to lessen concerns related to the interval-censored nature of MPL responses, which we in any case address statistically (see footnote 14).[9] Also, our subjects can anytime make decisions in a non-monotonic manner, which may well indicate indifference. We tackle these (very rare) cases by using wider price intervals to represent the concerned subjects' WTP, and we always do so in a way that favors the occurrence of IA violation.

2.3 Other design and implementation details

As already mentioned above, the lottery and baseline treatments for each pricing task were conducted in a between-subjects design. However, there is a within-subjects component in our design in that the hypothetical pricing of deferred payments was run as a "surprise" task following the hypothetical and real-stakes pricing of gift certificates. In particular, a lottery (baseline) treatment of the deferred payments task always followed a lottery (baseline) treatment of the gift certificates tasks. In Table 1 and Table 4, TP3 for instance denotes the deferred payments lottery treatment which followed the gift certificates lottery treatment T3. The deferred payments lottery treatments (TP3, TP5 and TP6) are identical except that each of them is preceded by a different gift certificates lottery treatment, and similarly for the deferred payments baseline treatments (TP4, TP7 and TP8).

While the instructions for the deferred payments task reminded subjects that they faced a new task unrelated to the gift certificates task just finished, the gift certificates valuation undoubtedly influenced the subsequent deferred payments valuation in some manner. However, given the variety of gift certificates lottery (baseline) treatments preceding the

[9] There is also some controversy regarding whether WTP can actually be elicited as precisely as required by mechanisms that elicit point-estimate responses, such as the BDM mechanism or the simplistic hypothetical elicitation mechanism that we use in the hypothetical pricing tasks. See, for example, Andersen et al. (2007) for further discussion.

deferred payments lottery (baseline) treatments, we can study this influence in a systematic manner when assessing the lottery-baseline treatment effect for the deferred payments task, as outlined in section 3.3. For this reason, we do not view the deferred payments valuations as less informative than the gift certificates valuations.

Both our initial and main studies were run in a pen-and-paper format as in GLW, and all sessions were conducted by the first author in Czech (the experimental instructions in the Appendix are translations of the original Czech instructions). All parts of the experiment were anonymous and the payments as well as lottery draws (if any) were done privately at the end of a session. Including an initial demographic questionnaire, hypothetical sessions lasted about 20 minutes while sessions involving the real-stakes pricing task lasted slightly longer. Subjects earned 100CZK (about $5) for participating in the hypothetical sessions, while the participation fee was 400CZK or 200CZK in sessions involving the real-stakes pricing task (see section 2.2).

The initial study was conducted in early April 2007 while the main study in early December 2008. Subjects in our initial study were 64 students from the Faculty of Social Sciences of the Charles University in Prague, recruited using posters. Subjects in our main study were 150 students from various Prague universities recruited online using ORSEE (Greiner 2004). Just above a third of them were students from various branches of engineering, one quarter were students of finance, business, management or accounting, another quarter were economists, and the remainder came from other fields. Subjects were 18 to 30 years old with the mean and median age of 22 years, and 67% of them were males.

3. Results

Before reporting our results, a (perhaps obvious) note of caution is in order.[10] In any between-subjects study of this kind, one would hope that the subject pool is reasonably homogenous (or treatments properly randomized) in relevant aspects, in order to permit unconditional lottery-baseline treatment comparisons; or that observable demographic characteristics can account for relevant across-treatment differences in subject pool composition and hence permit conditional treatment comparisons. One should nevertheless

[10] This cautionary note is *not* meant to imply that GLW and other studies of the *uncertainty effect* are unaware of the potential caveats of using a between-subjects design.

be open to the possibility that, even if the *uncertainty effect* as described by GLW is nonexistent, genuinely lower gift certificates valuation (real-stakes or hypothetical) in the lottery treatment compared to the baseline treatment could *in principle* generate IA violation. By similar token, genuinely higher time discounting of the deferred payments in the lottery treatment compared to the baseline treatment could *in principle* generate IA violation. Also, high risk aversion of subjects in the lottery treatments could contribute to – though by itself not generate – IA violation.[11]

We report both unconditional tests for the lottery-baseline treatment effect (*t*-test, Wilcoxon rank-sum test and Kolmogorov-Smirnov test) as well as *t*-tests (or Wald tests) that condition on the collected demographic characteristics (age, gender, year and field of study, and a wealth proxy related to family car ownership).[12] However, we remain cautious that the reported treatment effects might be affected by across-treatment differences in gift certificates valuation, time preferences or other relevant individual characteristics that we do not account for. What gives us some confidence in our results is that, across all three pricing tasks, we observe a systematic lottery-baseline treatment effect in the direction of the IA (contrary to the systematic IA violation documented by GLW).

Since the stakes (real or hypothetical) are substantial across the three pricing tasks, we report all WTP figures as percentages of x, i.e., the face value of the worse gift certificate or deferred payment. This permits a clearer comparison of WTP valuations across tasks and vis-à-vis previous studies. Any such between-subjects comparison should naturally be interpreted with the above cautionary note in mind. In sections 3.1-3.3 below, treatments are numbered as in Table 1 and additionally have a short verbal description in accordance with the earlier discussion.

[11] Here we mean a standard concept of risk aversion, broadly defined but quite different from Sonsino's (2008) "lottery aversion" concept discussed in our footnote 8.

[12] Some of the tests may be deemed more appropriate than others depending on how one views the nature of the data – see also footnote 9.

3.1 Hypothetical pricing of gift certificates

Table 2 displays summary statistics and beneath them statistical tests for the hypothetical pricing of gift certificates, jointly for our initial and main study.[13] Focusing first on the three lottery treatments T1-T3, WTP valuations are very similar in T3 (using the physical lottery format) and T1 (replicating GLW's lottery instructions). On the other hand, WTP valuations are considerably higher in T2 (rewording GLW's lottery instructions), and significantly so as shown in the first three test rows. This discrepancy may be due to the different presentation of the lottery structure in T2, but as noted above, it may be at least partly due to across-treatment differences in subject pool composition that we do not account for. For further comparison, all three of our lottery treatments have higher WTP valuations compared to GLW where the corresponding 95% confidence interval for WTP mean is merely (18.83, 45.66), and also compared to the corresponding 95% confidence interval of (50.00, 94.80) in Keren and Willemsen (2008; Experiment 2, taking only subjects passing their lottery comprehension test).

Turning next to our baseline treatment T4, the 95% confidence interval for WTP mean is (59.18, 79.22), while GLW's corresponding confidence interval is (41.38, 63.02) and Keren and Willemsen's (2008; Experiment 2) confidence interval is (45.20, 60.00). Although our sample size in T4 is relatively small, this comparison of baseline treatments seems to indicate higher "genuine" (though hypothetical) valuations of gift certificates in our study compared to the other two studies. Other things equal, this would work in favor of us finding IA violation, but we observe even higher WTP valuations in the lottery treatments, as detailed next.

In particular, the most appropriate lottery-baseline comparison is between T3 and T4 that share the implementation features of our main study. The treatment effect is clearly in the direction of the IA: as the fourth test row shows, WTP valuations are significantly higher in the lottery treatment T3 than in the baseline treatment T4. Not reported in Table 2,

[13] In the OLS estimation yielding the conditional *t*-test statistics, the collected demographic characteristics are jointly significant at the 5% level and subjects' year of study is individually significant at the 5% level (other controls including session dummies are individually insignificant at the 10% level). We omit the wealth proxy from the final estimation since it could be viewed as a controversial indicator of subjects' wealth and is in any case highly insignificant.

comparing the baseline treatment T4 with the initial study's lottery treatments, T1 and T2, yields statistically even stronger support for the IA.

3.2 Real-stakes pricing of gift certificates

Table 3 displays summary statistics and beneath them statistical tests for the real-stakes pricing of gift certificates.[14] Out of the 109 subjects completing the task, we detect three incomplete responses which clearly signal misunderstanding of the MPL valuation procedure (one in a lottery treatment and two in a baseline treatment) and consequently exclude these subjects from the analyzed sample. We further observe two subjects entering a non-monotonic response: a single No response preceded and followed by Yes responses. We treat these one-off cases of non-monotonicity by recoding the non-monotonic No responses as Yes responses, which favors IA violation since both subjects happen to be in a baseline treatment.

We start with assessing the extent of the mid-table effect. The lottery treatment T6 with the asymmetric MPL has slightly lower WTP valuations compared to the lottery treatment T5 with the symmetric MPL, which is in the direction of the mid-table effect. However, the across-treatment differential is small and far from significant, as shown in the first test row. There is stronger evidence for the mid-table effect in the baseline treatments, where T8 with the narrow MPL price range has considerably lower WTP valuations than does T7 with the wide MPL price range. The across-treatment differential is statistically significant, as shown in the second test row.

We next turn to the lottery-baseline treatment effect, which can be evaluated in several ways. One can pool the lottery treatments T5 and T6 and the baseline treatments T7 and T8, as done in columns (5) and (6) of Table 3, respectively. This yields 95% confidence intervals for WTP mean of (74.83, 92.91) for the lottery treatments and (56.57, 69.85) for the baseline treatments. Hence the treatment effect is clearly in the direction of the IA, as is also confirmed in the third test row. Alternatively, one can make stricter treatment comparisons

[14] In the interval regression estimation that takes into account the interval-censored nature of the MPL responses and yields the conditional Wald test statistics, the collected demographic characteristics are jointly significant at the 10% level and subjects' age is individually significant at the 5% level (other controls including session dummies are individually insignificant at the 10% level). We again omit the wealth proxy from the final estimation for reasons explained in footnote 13.

that favor IA violation, for example by excluding the baseline treatment T8 with the narrow MPL price range (see the fourth test row), or by contrasting only the lottery treatment T6 with the asymmetric MPL and the baseline treatment T7 with the wide MPL price range (see the fifth test row). Even these stricter comparisons provide clear support for the IA.

For comparison, GLW's lottery treatment yields much lower WTP valuations compared to ours: the corresponding 95% confidence interval for WTP mean is (40.34, 71.66). On the other hand, GLW's baseline treatment yields a 95% confidence interval for WTP mean of (66.77, 85.23), which is higher than in our case but not so much higher than in our baseline treatment T7. This latter comparison seems to suggest comparable "genuine" valuations of gift certificates in our and GLW's study.

Bearing in mind the design and implementation differences, one can further compare the hypothetical and real-stakes WTP valuations of gift certificates in our Table 2 and Table 3, respectively. Casual comparison suggests that there is a minor upward hypothetical bias in both the lottery and baseline treatments (excluding for now the exceptionally high valuations in T2). By contrast, similar comparison of GLW's hypothetical and real-stakes WTP valuations suggests a downward hypothetical bias in both the lottery and baseline treatments.

3.3 Hypothetical pricing of deferred payments

Table 4 displays summary statistics and beneath them statistical tests for the hypothetical pricing of deferred payments.[15] As explained in section 2.3, the lottery (baseline) treatments of this task followed the lottery (baseline) treatments of the gift certificates pricing tasks. Spearman's rank correlation coefficient between WTP valuations in the gift certificates and deferred payments treatments ranges between 0.27 and 0.60. The correlation is generally higher for the lottery treatments than for the corresponding baseline treatments, which is likely due to subjects' risk preferences affecting both of their valuations in the lottery treatments whereas the baseline treatments lack this common valuation factor.

[15] In the OLS estimation yielding the conditional *t*-test statistics, the collected demographic characteristics are jointly significant at the 10% level and subjects' field of study is individually significant at the 5% level (other controls including session dummies are individually insignificant at the 10% level). We again omit the wealth proxy from the final estimation for reasons explained in footnote 13.

The lottery-baseline treatment effect can again be evaluated in several ways. One can pool all lottery treatments and all baseline treatments, as done in columns (1) and (2) of Table 4, respectively. This yields 95% confidence intervals for WTP mean of (70.28, 87.66) for the lottery treatments and (41.62, 54.89) for the baseline treatments. Hence the overall treatment effect is clearly in the direction of the IA, as confirmed in the first test row. Alternatively, one can evaluate the treatment effect separately for the treatments following the real-stakes gift certificates treatments (as done in columns (3) and (4) and tested in the second test row), and for the treatments following the hypothetical gift certificates treatments (as done in columns (5) and (6) and tested in the third test row). These separate comparisons both provide clear support for the IA.

For comparison, GLW's lottery treatment yields much lower WTP valuations than ours: the corresponding 95% confidence interval for WTP mean is merely (19.51, 45.49). GLW's baseline treatment yields a 95% confidence interval of (34.02, 53.18), which is only marginally lower than in our case (see columns (2), (4) and (6) of Table 4). Thus "genuine" valuations of deferred payments are quite comparable in our and GLW's study.

We next address in more detail how subjects' WTP valuations in the deferred payments task are influenced by their previous gift certificates valuations. Comparing column (3) with column (5) and column (4) with column (6), and inspecting the fourth test row, one can see that WTP valuations of deferred payments are significantly higher when preceded by hypothetical rather than real-stakes gift certificates valuations. This could indicate a kind of anchoring effect related to the upward hypothetical bias of the gift certificates valuations reported in section 3.2. Alternatively, it could also indicate a "disciplining" effect of the real-stakes gift certificates elicitation mechanism, which is fully incentive-compatible and thus may give subjects who experience it a better idea of how to approach the subsequent hypothetical pricing of deferred payments.

To further investigate this issue, we compare WTP valuations in the deferred payments lottery treatments TP5 and TP6 that were preceded by the real-stakes gift certificates lottery treatments. The fifth test row shows that WTP valuations in TP5 are only slightly higher than in TP6, which matches the results for the preceding gift certificates treatments T5 and T6. We further compare WTP valuations in the deferred payments baseline treatments TP7 and TP8 that were preceded by the real-stakes gift certificates baseline treatments. As the sixth test row shows, WTP valuations in TP7 are only slightly higher than in TP8, which

contrasts with the much larger difference in WTP valuations between the preceding gift certificates treatments T7 and T8. This last result suggests that the anchoring effect is not so strong and that the disciplining effect (or some such alternative effect) may play a role.

4. Discussion and conclusion

We systematically observe that the internality axiom is *not* violated. Subjects' willingness to pay for equiprobable binary lotteries is significantly higher than other subjects' willingness to pay for the lotteries' worse outcomes, regardless of whether the WTP valuation is real-stakes or hypothetical and whether the outcomes are gift certificates or deferred payments.

We do not wish to draw any overreaching conclusions about the reality of IA violation (and hence the *uncertainty effect*) systematically documented by GLW. As noted in section 3, under between-subjects design, genuinely higher gift certificates or deferred payments valuation in a baseline treatment compared to a corresponding lottery treatment could in principle produce IA violation, even if GLW's *uncertainty effect* is nonexistent. Nevertheless, we observe that, with our implementation of the pricing tasks and in our subject pool, IA violation is (statistically) extremely unlikely.

The implementation in our main study rests on using a physical lottery format that arguably renders misinterpretation of the lottery structure highly unlikely, and on providing subjects with complete information about the goods they are to value. Either of these features could have contributed to our results differing dramatically from GLW's. The physical lottery format likely plays a role, given Keren and Willemsen's (2008) finding that verbally presenting the lottery in terms of a coin flip or a spinner wheel helps alleviate IA violation (though 13-31% of subjects still misunderstand the lottery structure). Providing complete information about the to-be-valued goods is unlikely to play a critical role, given that Sonsino (2008) uses this implementation feature but still observes some IA violation even in a within-subjects design.[16]

Our results could of course be specific to our subject pool – Prague students with varied academic background and other demographic characteristics. Nevertheless, conditioning on

[16] Unfortunately, other design and implementation features of Sonsino's and our study differ too widely to draw any firm conclusions about the discrepancy in the results.

the observable characteristics when evaluating the lottery-baseline treatment effect leaves our results qualitatively unchanged. While it is difficult to judge whether our subject pool differs from that of GLW (University of Chicago students), we observe that the two subject pools mostly have comparable genuine (baseline-treatment) valuations of gift certificates and deferred payments. Naturally, replicating our implementation of GLW's tasks with other subject pools would add to our understanding of the external validity of our results.

We do not wish to dispute that GLW's lottery design may involve high cognitive demands or perception of uncertainty or both, which may trigger a valuation process incompatible with risky decision theories. After all, like GLW, we did not trace the valuation process that our subjects actually used. However, our results suggest that at least part of what GLW call the *uncertainty effect* might be triggered by their verbal lottery instructions obstructing the application of the IA. The relatively low lottery valuations might, for instance, stem from subjects' aversion to undetermined lottery probabilities, in the spirit of Sonsino's (2008) lottery aversion explanation (see above) and a common interpretation of Ellsberg-type paradoxes (see, e.g., Nau 2007).

In psychology, verbally described tasks (word problems) similar to GLW's are ubiquitously used in research on probabilistic or logical reasoning. Many psychologists have emphasized that a primary source of ambiguity in word problems stems from the use of ambiguous natural language terms and experimenters' violations of conversational norms (e.g., Adler 1991; Hilton 1995; Evans 2002; Schwarz et al. 1991; but see also Mellers et al. 2001). To interpret people's behavior as violating rules of logic, probability theory or axioms of rational choice theory, the experimenter needs to assume that the word problem represents nothing more than instantiations of normative rules. Yet in inferring the intended meaning of words or utterances, experimental subjects may arrive at interpretations that diverge from those of experimenters (e.g., Evans 2002; Gigerenzer et al. 1988; Hertwig and Gigerenzer 1999; Politzer and Noveck 1991). Thus experimenters, in equating their and subjects' understanding of the task, may erroneously interpret subjects' behavior as irrational (see also Harrison 2005).

References

Adler, J.E. (1991). An optimist's pessimism: Conversation and conjunction. Posnan Studies in the Philosophy of the Sciences and Humanities, 21, 251–282.

Andersen, S., Harrison, G.W., Lau, M.I., & Rutstrom, E.E. (2007). Valuation using multiple price list formats. Applied Economics, 39(6), 675–682.

Evans, J.St.B.T. (2002). Logic and human reasoning: An assessment of the deduction paradigm. Psychological Bulletin, 128(6), 978–996.

Gigerenzer, G., Hell, W., & Blank, H. (1988). Presentation and content: The use of base rates as a continuous variable. Journal of Experimental Psychology: Human Perception and Performance, 14(3), 513-525.

Gneezy, U., List, J.A., & Wu, G. (2006). The uncertainty effect: When a risky prospect is valued less than its worst outcome. Quarterly Journal of Economics, 121(4), 1283–1309.

Greiner, B. (2004). The online recruitment system ORSEE 2.0 – A guide for the organization of experiments in economics. University of Cologne, Working Paper Series in Economics 10.

Grether, D.M., & Plott, C.R. (1979). Economic theory of choice and the preference reversal phenomenon. American Economic Review, 69(4), 623-638.

Harrison, G.W. (1992). Theory and misbehavior of first-price auctions: Reply. American Economic Review, 82(5), 1426-1443.

Harrison, G.W. (2005). Field experiments and control. In J. Carpenter, G.W. Harrison, & List, J.A. (Eds.), Field Experiments in Economics (Vol. 10). Greenwich, CT: JAI Press.

Harrison, G.W., List, J.A., & Towe, C. (2007). Naturally occurring preferences and exogenous laboratory experiments: A case study of risk aversion. Econometrica, 75(2), 433-458.

Hertwig, R., & Gigerenzer, G. (1999). The 'conjunction fallacy' revisited: How intelligent inferences look like reasoning errors. Journal of Behavioral Decision Making, 12(4), 275–305.

Hilton, D.J. (1995). The social context of reasoning: Conversational inference and rational judgment. Psychological Bulletin, 118(22), 248–271.

Horowitz, J.K. (2006). The Becker-DeGroot-Marschak mechanism is not necessarily incentive compatible, even for non-random goods. Economics Letters, 93(1), 6–11.

Karni, E., & Safra, Z. (1987). Preference reversals and the observability of preferences by experimental methods. Econometrica, 55(3), 675–685.

Keren, G., & Willemsen, M.C. (2008). Decision anomalies, experimenter assumptions, and participants' comprehension: Re-evaluating the uncertainty effect. Journal of Behavioral Decision Making, in press.

Mellers, B., Hertwig, R., & Kahneman, D. (2001). Do frequency representations eliminate conjunction effects? An exercise in adversarial collaboration. Psychological Science, 12(4), 269–275.

Nau, R.F. (2007). Extensions of the subjective expected utility model. In W. Edwards, R.F. Miles Jr., & D. von Winterfeldt (Eds.), Advances in Decision Analysis: From Foundation to Applications. New York, NY: Cambridge University Press.

Ortmann, A., Prokosheva, S., Rydval, O., & Hertwig, R. (2007). Valuing a risky prospect less than its worst outcome: Uncertainty effect or task ambiguity? Jena Economic Research Paper 2007-038 and CERGE-EI Working Paper 334.

Politzer, G., & Noveck, I.A. (1991). Are conjunction rule violations the result of conversational rule violations? Journal of Psycholinguistic Research, 20(2), 83–103.

Schwarz, N., Strack, F., Hilton, D., & Naderer, G. (1991). Base rates, representativeness, and the logic of conversation: The contextual relevance of "irrelevant' information. Social Cognition, 9(1), 67–84.

Simonsohn, U. (2008). Direct-risk-aversion: Evidence from risky prospects valued below their worst outcome. Psychological Science, forthcoming.

Sonsino, D. (2008). Disappointment aversion in internet bidding-decisions. Theory and Decision, 64(2-3), 363–393.

Table 1: Design matrix of pricing tasks and treatments

	Hypothetical pricing of gift certificates	Real-stakes pricing of gift certificates	Hypothetical pricing of deferred payments
Lottery treatments	T1, T2, T3	T5, T6	TP3, TP5, TP6
Baseline treatments	T4	T7, T8	TP4, TP7, TP8

Table 2: Willingness to pay in the hypothetical pricing of gift certificates [a]

Column	(1)	(2)	(3)	(4)
Treatment	**T1 (replication lottery)**	**T2 (reworded lottery)**	**T3 (physical lottery)**	**T4 (baseline)**
Number of subjects	32	32	26	15
Mean WTP (standard deviation)	90.31 (32.89)	111.03 (25.87)	88.22 (34.00)	69.20 (18.09)
Median WTP	100.00	105.00	98.90	70.00
95% C.I. for WTP mean	(78.46, 102.17)	(101.70, 120.35)	(74.49, 101.95)	(59.18, 79.22)
95% binomial exact C.I. for WTP median	(60.00, 100.00)	(100.00, 130.00)	(80.00, 100.00)	(60.00, 84.00)
Null hypothesis tested	*t*-test	*t*-test with controls	Wilcoxon rank-sum test	Kolmog.-Smirnov test
H_0: T1-T3=0	$t = 0.24$, $p = 0.8135$	$t = -0.07$, $p = 0.945$	$Z = 0.31$, $p = 0.7575$	$M = 0.11$, $p = 0.980$
H_0: T2-T1=0	$t = 2.80$, $p = 0.0068$	$t = 2.93$, $p = 0.004$	$Z = 2.56$, $p = 0.0105$	$M = 0.34$, $p = 0.045$
H_0: T2-T3=0	$t = 2.90$, $p = 0.0053$	$t = 2.21$, $p = 0.030$	$Z = 2.91$, $p = 0.0036$	$M = 0.38$, $p = 0.020$
H_0: T3-T4=0	$t = 2.34$, $p = 0.0247$	$t = 2.47$, $p = 0.015$	$Z = 2.25$, $p = 0.0243$	$M = 0.47$, $p = 0.018$

[a] The top part of the table displays summary statistics for various treatments while the bottom part displays tests for across-treatment differences (H_0 and the corresponding tests to the right of it). All WTP figures are percentages of x=500CZK. All tests are two-sided. Test statistics are rounded to 2 decimal places and *p*-values are left at the precision reported by *Stata*. *t*-tests with demographic controls are based on heteroskedasticity-robust standard errors. Exact *p*-values are reported for the Kolmogorov-Smirnov test.

Table 3: Willingness to pay in the real-stakes pricing of gift certificates [b]

Column	(1)	(2)	(3)	(4)	(5)	(6)
Treatment(s)	**T5 (lottery with symmetric MPL)**	**T6 (lottery with asymmetric MPL)**	**T7 (baseline with wide price range)**	**T8 (baseline with narrow price range)**	**T5,6 (pooled lottery treatments)**	**T7,8 (pooled baseline treatments)**
Number of subjects	35	18	39	14	53	53
Mean WTP (standard deviation)	86.57 (36.21)	78.61 (24.96)	66.67 (23.32)	53.57 (24.37)	83.87 (32.80)	63.21 (24.08)
Median WTP	100.00	90.00	70.00	55.00	100.00	60.00
95% C.I. for WTP mean	(74.13, 99.01)	(66.20, 91.02)	(59.11, 74.23)	(39.50, 67.64)	(74.83, 92.91)	(56.57, 69.85)
95% binomial exact C.I. for WTP median	(80.00, 100.00)	(60.00, 100.00)	(50.00, 80.00)	(30.00, 80.00)	(75.00, 100.00)	(50.00, 70.00)
Null hypothesis tested	*t*-test	Wald test with controls	Wilcoxon rank-sum test	Kolmog.-Smirnov test		
H_0: T5-T6=0	$t = 0.83$, $p = 0.4080$	$t = 0.98$, $p = 0.329$	$Z = 1.40$, $p = 0.1625$	$M = 0.23$, $p = 0.485$		
H_0: T7-T8=0	$t = 1.78$, $p = 0.0808$	$t = 1.49$, $p = 0.137$	$Z = 1.67$, $p = 0.0950$	$M = 0.28$, $p = 0.322$		
H_0: T5,6-T7,8=0	$t = 3.70$, $p = 0.0004$	$t = 4.06$, $p = 0.000$	$Z = 3.90$, $p = 0.0001$	$M = 0.45$, $p = 0.000$		
H_0: T5,6-T7=0	$t = 2.94$, $p = 0.0042$	$t = 3.45$, $p = 0.001$	$Z = 3.18$, $p = 0.0015$	$M = 0.43$, $p = 0.001$		
H_0: T6-T7=0	$t = 1.76$, $p = 0.0843$	$t = 1.99$, $p = 0.047$	$Z = 1.87$, $p = 0.0613$	$M = 0.30$, $p = 0.165$		

[b] The top part of the table displays summary statistics for various treatments while the bottom part displays tests for across-treatment differences (H_0 and the corresponding tests to the right of it). All WTP figures are percentages of x=200CZK. All tests are two-sided. Test statistics are rounded to 2 decimal places and *p*-values are left at the precision reported by *Stata*. Wald tests with demographic controls are based on heteroskedasticity-robust standard errors. Exact *p*-values are reported for the Kolmogorov-Smirnov test.

Table 4: Willingness to pay in the hypothetical pricing of deferred payments [c]

Column	(1)	(2)	(3)	(4)	(5)	(6)
Treatment(s)	**TP3,5,6 (pooled lottery treatments)**	**TP4,7,8 (pooled baseline treatments)**	**TP5,6 (lotteries after real certificates)**	**TP7,8 (baselines after real certificates)**	**TP3 (lottery after hypothet. certificates)**	**TP4 (baseline after hypothet. certificates)**
Number of subjects	80	70	54	55	26	15
Mean WTP (standard deviation)	78.97 (39.04)	48.25 (27.83)	75.65 (38.94)	44.70 (27.57)	85.87 (39.10)	61.27 (25.60)
Median WTP	80.00	50.00	80.00	40.00	85.00	70.00
95% C.I. for WTP mean	(70.28, 87.66)	(41.62, 54.89)	(65.02, 86.28)	(37.25, 52.16)	(70.07, 101.66)	(47.09, 75.44)
95% binomial exact C.I. for WTP median	(60.00, 99.00)	(40.00, 60.00)	(60.00, 99.00)	(36.00, 60.00)	(60.00, 120.00)	(50.00, 80.00)
Null hypothesis tested	*t*-test	*t*-test with controls	Wilcoxon rank-sum test	Kolmog.-Smirnov test		
H_0: TP3,5,6-TP4,7,8=0	$t = 5.60$, $p = 0.0000$	$t = 6.65$, $p = 0.000$	$Z = 4.97$, $p = 0.0000$	$M = 0.43$, $p = 0.000$		
H_0: TP5,6-TP7,8=0	$t = 4.78$, $p = 0.0000$	$t = 5.37$, $p = 0.000$	$Z = 4.29$, $p = 0.0000$	$M = 0.43$, $p = 0.000$		
H_0: TP3-TP4=0	$t = 2.18$, $p = 0.0357$	$t = 3.17$, $p = 0.002$	$Z = 1.95$, $p = 0.0515$	$M = 0.43$, $p = 0.037$		
H_0: TP3,4-TP5,6,7,8=0	$t = 2.50$, $p = 0.0137$	$t = 2.30$, $p = 0.023$	$Z = 2.35$, $p = 0.0190$	$M = 0.21$, $p = 0.108$		
H_0: TP5-TP6=0	$t = 0.47$, $p = 0.6414$	$t = 0.73$, $p = 0.467$	$Z = 0.72$, $p = 0.4724$	$M = 0.22$, $p = 0.577$		
H_0: TP7-TP8=0	$t = 0.46$, $p = 0.6455$	$t = 0.30$, $p = 0.764$	$Z = 0.42$, $p = 0.6755$	$M = 0.14$, $p = 0.953$		

[c] The top part of the table displays summary statistics for various treatments while the bottom part displays tests for across-treatment differences (H_0 and the corresponding tests to the right of it). All WTP figures are percentages of x=500CZK. All tests are two-sided. Test statistics are rounded to 2 decimal places and *p*-values are left at the precision reported by *Stata*. *t*-tests with demographic controls are based on heteroskedasticity-robust standard errors. Exact *p*-values are reported for the Kolmogorov-Smirnov test.

Appendix A: Experimental instructions for the hypothetical pricing of gift certificates, lottery treatment T1

Instructions for the experiment

Imagine that we offer you a lottery ticket that gives you a 50 percent chance at a 500 CZK gift certificate for the Luxor Book Palace at Wenceslas Square, and a 50 percent chance at a 1,000 CZK gift certificate for the Luxor Book Palace. Whichever gift certificate you win is good for use for the next two weeks. What is the highest amount of money you would be willing to pay for this lottery ticket?

Your answer:____CZK

Appendix B: Experimental instructions for the hypothetical pricing of gift certificates, lottery treatment T2

Instructions for the experiment

Imagine that we offer you a gift certificate for the Luxor Book Palace at Wenceslas Square. With a chance of 50 percent it is a certificate worth $50, and with a chance of 50 percent it is a certificate worth $100. Whether the gift certificate is worth $50 or $100 is determined by flipping a fair coin. Whichever gift certificate you receive will be good for use for the next two weeks. What is the highest amount of money you would be willing to pay for this gift certificate?

Your answer:____CZK

Appendix C: Experimental instructions for the hypothetical pricing of gift certificates, lottery treatment T3

Instructions for the experiment

In this experiment, we will ask you a hypothetical question. Regardless of your answer, you will earn 100CZK for participating. Please read the instructions carefully and then write your answer at the end of the instructions. If you have any queries, please raise your hand. The experimenter will come to you and answer your query privately.

Your task is as follows. The bag on the table in front of the experimenter contains two gift certificates for purchase of goods at the Luxor Book Palace (Neoluxor) at Wenceslas square. **The two gift certificates are identical, except that one of them has a value of 500CZK while the other has a value of 1000CZK.** Each certificate is valid for the next three months and entitles the owner to purchase goods for up to the value of the certificate, for example, various kinds of books including CD and DVD formats, maps, stationery, and so on. The certificates can also be used to make purchases in the Neoluxor internet shop.

Now imagine you had an opportunity to draw **one** gift certificate from the bag. You would not be able to look into the bag while drawing, and since the two certificates in the bag are identical (except for their value), you would have equal (50-50) chances of drawing either the 500CZK or the 1000CZK certificate.

Our question is as follows: **What is the highest price (in CZK) you would be willing to pay for the opportunity of drawing one certificate from the bag?** Please write your answer here:

_____

Appendix D: Experimental instructions for the hypothetical pricing of gift certificates, baseline treatment T4

Instructions for the experiment

In this experiment, we will ask you a hypothetical question. Regardless of your answer, you will earn 100CZK for participating. Please read the instructions carefully and then write your answer at the end of the instructions. If you have any queries, please raise your hand. The experimenter will come to you and answer your query privately.

Your task is as follows. The experimenter will show you a **500CZK gift certificate for purchase of goods at the Luxor Book Palace (Neoluxor) at Wenceslas square**. The gift certificate is valid for the next three months and entitles the owner to purchase goods for up to 500CZK, for example, various kinds of books including CD and DVD formats, maps, stationery, and so on. The certificates can also be used to make purchases in the Neoluxor internet shop.

Our question is as follows: **What is the highest price (in CZK) you would be willing to pay for this certificate?** Please write your answer here:

_____

Appendix E: Experimental instructions for the real-stakes pricing of gift certificates, lottery treatment T6 with the asymmetric MPL (lottery treatment T5 has identical instructions except for the symmetric MPL)

Instructions for the experiment

In this experiment, we give you **400CZK for participating**. How much you earn in total will depend on your decisions. Please read the instructions carefully and then indicate your decisions on the attached ANSWER SHEET. If you have any queries, please raise your hand. The experimenter will come to you and answer your query privately.

Your task is as follows. The bag on the table in front of the experimenter contains two gift certificates for purchase of goods at the Luxor Book Palace (Neoluxor) at Wenceslas square. **The two gift certificates are identical, except that one of them has a value of 200CZK while the other has a value of 400CZK.** Each certificate is valid for the next three months and entitles the owner to purchase goods for up to the value of the certificate, for example, various kinds of books including CD and DVD formats, maps, stationery, and so on. The certificates can also be used to make purchases in the Neoluxor internet shop.

Now imagine you have an opportunity to draw **one** gift certificate from the bag. You would not be able to look into the bag while drawing, and since the two certificates in the bag are identical (except for their value), you would have equal (50-50) chances of drawing either the 200CZK or the 400CZK certificate.

Our question is as follows: **What is the highest price (in CZK) you are willing to pay for the opportunity of drawing one certificate from the bag?**

Please answer our question by filling out the attached ANSWER SHEET. In the ANSWER SHEET, we are asking you to make 20 decisions. In each row, we are asking you whether you are willing to pay the displayed price for the opportunity of drawing one certificate from the bag. In Row 1, for example, we are asking you whether you are willing to pay 20CZK for the opportunity of drawing one certificate from the bag. If you circle YES, you are saying that you are willing to pay 20CZK, whereas if you circle NO, you are saying that you are not willing to pay 20CZK. You will make similar decisions in all the remaining rows, except that the displayed price increases as you move down the ANSWER SHEET. Thus by circling YES or NO in each row, you will indicate the highest price you are willing to pay for the opportunity of drawing one certificate from the bag.

As we said at the beginning, we give you 400CZK for participating. You can use this amount to pay for the opportunity of drawing one certificate from the bag. Note that 400CZK would be enough to pay even the highest price displayed in the last row of the ANSWER SHEET.

After you will have made all 20 decisions, we will collect your ANSWER SHEET. At the end of this experimental session, the following procedure will follow:

1. The experimenter will invite you individually to another room and will find your ANSWER SHEET based on your anonymous ID number.

2. Then you will select randomly (without looking) one card from a box with 20 cards numbered 1 to 20. The number on the selected card will determine the row in your ANSWER SHEET that will be relevant for your earnings in this experiment. You of course do not know which row you will select, but you know that each row is equally likely to be selected. It is therefore important that you make a careful decision in **each** of the 20 rows.

3. Depending on your decision in the selected row, one of the following two situations, A or B, will happen:

A. If you circled YES in the selected row, you will pay us the price displayed in that row. We will simply subtract the price from the 400CZK you get for participating. The remainder of the 400CZK (after subtracting the price) will be paid to you by the experimenter in cash. Then you will have the opportunity of drawing one certificate from the bag, as described above. The experimenter will place a 200CZK and a 400CZK certificate in the bag and you will draw one of them (without looking into the bag). The certificate that you draw will be yours to keep.

B. If you circled NO in the selected row, you are saying that you are not willing to pay the price displayed in that row. Thus you will not pay us anything, but you will also not have the opportunity of drawing a certificate from the bag. The 400CZK for participating will be paid to you by the experimenter in cash.

Now please fill out the attached ANSWER SHEET.

ANSWER SHEET

Please circle either YES or NO in each row. This will indicate whether you are willing to pay the displayed price for the opportunity of drawing one certificate from the bag. As explained above, the bag contains two gift certificates for purchase of goods at the Luxor Book Palace. The certificates are identical except that one of them has a value of 200CZK while the other has a value of 400CZK.

Row 1	I am willing to pay **20CZK**	YES	NO
Row 2	I am willing to pay **40CZK**	YES	NO
Row 3	I am willing to pay **50CZK**	YES	NO
Row 4	I am willing to pay **60CZK**	YES	NO
Row 5	I am willing to pay **80CZK**	YES	NO
Row 6	I am willing to pay **90CZK**	YES	NO
Row 7	I am willing to pay **100CZK**	YES	NO
Row 8	I am willing to pay **120CZK**	YES	NO
Row 9	I am willing to pay **140CZK**	YES	NO
Row 10	I am willing to pay **150CZK**	YES	NO
Row 11	I am willing to pay **160CZK**	YES	NO
Row 12	I am willing to pay **180CZK**	YES	NO
Row 13	I am willing to pay **200CZK**	YES	NO
Row 14	I am willing to pay **220CZK**	YES	NO
Row 15	I am willing to pay **240CZK**	YES	NO
Row 16	I am willing to pay **260CZK**	YES	NO
Row 17	I am willing to pay **280CZK**	YES	NO
Row 18	I am willing to pay **320CZK**	YES	NO
Row 19	I am willing to pay **360CZK**	YES	NO
Row 20	I am willing to pay **400CZK**	YES	NO

Appendix F: Experimental instructions for the real-stakes pricing of gift certificates, baseline treatment T7 with the wide MPL price range (baseline treatment T8 has identical instructions except for the narrow MPL price range, 10 decisions made, and 200CZK for participating)

Instructions for the experiment

In this experiment, we give you **400CZK for participating**. How much you earn in total will depend on your decisions. Please read the instructions carefully and then indicate your decisions on the attached ANSWER SHEET. If you have any queries, please raise your hand. The experimenter will come to you and answer your query privately.

Your task is as follows. The experimenter has at his disposal **200CZK gift certificates** for the purchase of goods at the Luxor Book Palace (Neoluxor) at Wenceslas square. Each certificate is valid for the next three months and entitles the owner to purchase goods for up to 200CZK, for example, various kinds of books including CD and DVD formats, maps, stationery, and so on. The certificates can also be used to make purchases in the Neoluxor internet shop.

Our question is as follows: **What is the highest price (in CZK) you are willing to pay for the gift certificate?**

Please answer our question by filling out the attached ANSWER SHEET. In the ANSWER SHEET, we are asking you to make 20 decisions. In each row, we are asking you whether you are willing to pay the displayed price for the gift certificate. In Row 1, for example, we are asking you whether you are willing to pay 20CZK for the gift certificate. If you circle YES, you are saying that you are willing to pay 20CZK, whereas if you circle NO, you are saying that you are not willing to pay 20CZK. You will make similar decisions in all the remaining rows, except that the displayed price increases as you move down the ANSWER SHEET. Thus by circling YES or NO in each row, you will indicate the highest price you are willing to pay for the gift certificate.

As we said at the beginning, we give you 400CZK for participating. You can use this amount to pay for the gift certificate. Note that 400CZK would be enough to pay even the highest price displayed in the last row of the ANSWER SHEET.

After you will have made all 20 decisions, we will collect your ANSWER SHEET. At the end of this experimental session, the following procedure will follow:

1. The experimenter will invite you individually to another room and will find your ANSWER SHEET based on your anonymous ID number.

2. Then you will select randomly (without looking) one card from a box with 20 cards numbered 1 to 20. The number on the selected card will determine the row in your ANSWER SHEET that will be relevant for your earnings in this experiment. You of course do not know which row you will select, but you know that each row is equally likely to be selected. It is therefore important that you make a careful decision in **each** of the 20 rows.

3. Depending on your decision in the selected row, one of the following two situations, A or B, will happen:

A. If you circled YES in the selected row, you will pay us the price displayed in that row. We will simply subtract the price from the 400CZK you get for participating. The remainder of the 400CZK (after subtracting the price) will be paid to you by the experimenter in cash, and you will also receive the 200CZK gift certificate.

B. If you circled NO in the selected row, you are saying that you are not willing to pay the price displayed in that row. Thus you will not pay us anything, but you will also not receive the gift certificate. The 400CZK for participating will be paid to you by the experimenter in cash.

Now please fill out the attached ANSWER SHEET.

ANSWER SHEET

Please circle either YES or NO in each row. This will indicate whether you are willing to pay the displayed price for the gift certificate. As explained above, this is a 200CZK gift certificate for purchase of goods at the Luxor Book Palace.

Row 1	I am willing to pay **20CZK**	YES	NO
Row 2	I am willing to pay **40CZK**	YES	NO
Row 3	I am willing to pay **60CZK**	YES	NO
Row 4	I am willing to pay **80CZK**	YES	NO
Row 5	I am willing to pay **100CZK**	YES	NO
Row 6	I am willing to pay **120CZK**	YES	NO
Row 7	I am willing to pay **140CZK**	YES	NO
Row 8	I am willing to pay **160CZK**	YES	NO
Row 9	I am willing to pay **180CZK**	YES	NO
Row 10	I am willing to pay **200CZK**	YES	NO
Row 11	I am willing to pay **220CZK**	YES	NO
Row 12	I am willing to pay **240CZK**	YES	NO
Row 13	I am willing to pay **260CZK**	YES	NO
Row 14	I am willing to pay **280CZK**	YES	NO
Row 15	I am willing to pay **300CZK**	YES	NO
Row 16	I am willing to pay **320CZK**	YES	NO
Row 17	I am willing to pay **340CZK**	YES	NO
Row 18	I am willing to pay **360CZK**	YES	NO
Row 19	I am willing to pay **380CZK**	YES	NO
Row 20	I am willing to pay **400CZK**	YES	NO

Appendix G: Experimental instructions for the hypothetical pricing of deferred payments, lottery treatments TP3, TP5 and TP6

Instructions for the experiment

In this part of today's experiment, we will ask you a hypothetical question which is in no way related to the part just finished. Your answer will not affect your earnings in today's experiment but is a precondition for completing the whole experiment. Please read the instructions carefully and then write your answer at the end of the instructions. If you have any queries, please raise your hand. The experimenter will come to you and answer your query privately.

Your task is as follows. The bag on the table in front of the experimenter contains two cheques which guarantee a payment in cash one year from now. **The two cheques are identical, except that one of them guarantees a payment of 500CZK one year from now, while the other one guarantees a payment of 1000CZK one year from now.** For both cheques, the payment is guaranteed by the Max-Planck-Gesellschaft – the research organization that finances this experiment.

Now imagine you had an opportunity to draw **one** cheque from the bag. You would not be able to look into the bag while drawing, and since the two cheques in the bag are identical (except for their value), you would have equal (50-50) chances of drawing either the 500CZK or the 1000CZK cheque.

Our question is as follows: **What is the highest price (in CZK) you would be willing to pay for the opportunity of drawing one cheque from the bag?** Please write your answer here:

_____

Appendix H: Experimental instructions for the hypothetical pricing of deferred payments, baseline treatments TP4, TP7 and TP8

Instructions for the experiment

In this part of today's experiment, we will ask you a hypothetical question which is in no way related to the part just finished. Your answer will not affect your earnings in today's experiment but is a precondition for completing the whole experiment. Please read the instructions carefully and then write your answer at the end of the instructions. If you have any queries, please raise your hand. The experimenter will come to you and answer your query privately.

Your task is as follows. The experimenter will show you a **cheque which guarantees a payment of 500CZK in cash one year from**. The payment is guaranteed by the Max-Planck-Gesellschaft – the research organization that finances this experiment.

Our question is as follows: **What is the highest price (in CZK) you would be willing to pay for the cheque?** Please write your answer here:

_____

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