On the Relation between Willingness to Accept and Willingness to Pay*

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Abstract

A vast literature documents that willingness to pay (WTP) is less than willingness to accept (WTA) a monetary amount for an object, a phenomenon called the *endowment effect*. Using data from three incentivized studies with a total representative sample of 4,000 U.S. adults, we add one additional finding: WTA and WTP for a lottery are (essentially) uncorrelated. In contrast, independent measures of WTA (or WTP) are highly correlated, and relatively stable across time. Leading models of reference-dependent preferences are compatible with a zero correlation between WTA and WTP, but only for specific parameterizations and ruling out popular special cases. These models also predict a relationship between the endowment effect and loss aversion, which we do not find.

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1 Introduction

Willingness to pay (WTP) a monetary amount for an object and willingness to accept (WTA) a monetary amount for an object should be essentially the same in standard economic theory.[1] An enormous experimental and empirical literature finds this is not the case: WTA is generally higher than WTP, a phenomenon referred to as the *endowment effect*.[2]

We add, and interpret, one finding to this vast literature: in our data, WTA and WTP are not only different, they have a correlation close to zero. That is, knowing that someone has a high WTA gives us almost no information about their WTP. Our results come from four large-scale, incentivized, representative surveys of U.S. adults totaling 4,000 participants, one of which was repeated six months later. For each participant, we measure WTA and WTP for two lottery tickets.[3] A lack of correlation between the two is consistent with models of reference-dependent preferences, albeit with specific restrictions that rule out commonly-used special cases. However, we also find no relationship between the endowment effect and loss aversion for risky bets involving gains and losses. This is inconsistent with a unified notion of loss aversion that explains both risky choice and the endowment effects.

Theory. In standard economic theory, WTA and WTP should coincide. Testing whether they are correlated is a novel way to falsify that theory. Models of reference-dependent preferences *can* be consistent with a zero correlation between WTA and WTP with very specific parameterizations. In our baseline specification, both WTA and WTP depend on the reference-free utility u for the object.[4] Loss aversion (λ) acts to increase WTA and decrease WTP. Thus, variance in u generates a positive correlation between the two, while variance in λ generates a negative relationship. A zero correlation between WTA and WTP is possible only when the variation in the value induced by heterogeneity in u is exactly equal to that induced by heterogeneity in λ, offsetting each other.

If this is the correct explanation for our main finding, it has two implications for models of

[1] This assumes that the value of the object is small enough that wealth effects are irrelevant.

[2] See Camerer (1995, p. 665), Dhami (2016, p. 217), and Marzilli Ericson and Fuster (2014) for reviews. We follow the majority of the literature in using the term endowment effect for the gap between WTA and WTP, although some explanations do not involve being endowed with the object.

[3] The previous literature has shown an endowment both for lottery tickets and for objects such as mugs, see for example Isoni, Loomes, and Sugden (2011).

[4] This specification is similar to that of Tversky and Kahneman (1991), which they use to explain the endowment effect in riskless choice. In Appendix C, we consider instead the approach of Kőszegi and Rabin (2007), with similar results.

reference-dependent preferences. First, it rules out the commonly-used formulation in which all small-scale risk aversion is due to loss aversion. In this case, there would be no variance of u so a zero correlation could only occur if there were no variance in λ. This, in turn, implies that all variance in our measures of WTA and WTP is due to noise, a possibility our data rules out. Second, this explanation also rules out the opposite case: in which the variation due to "behavioral" factors connected to loss aversion are secondary to "standard" factors connected to the utility for the object.

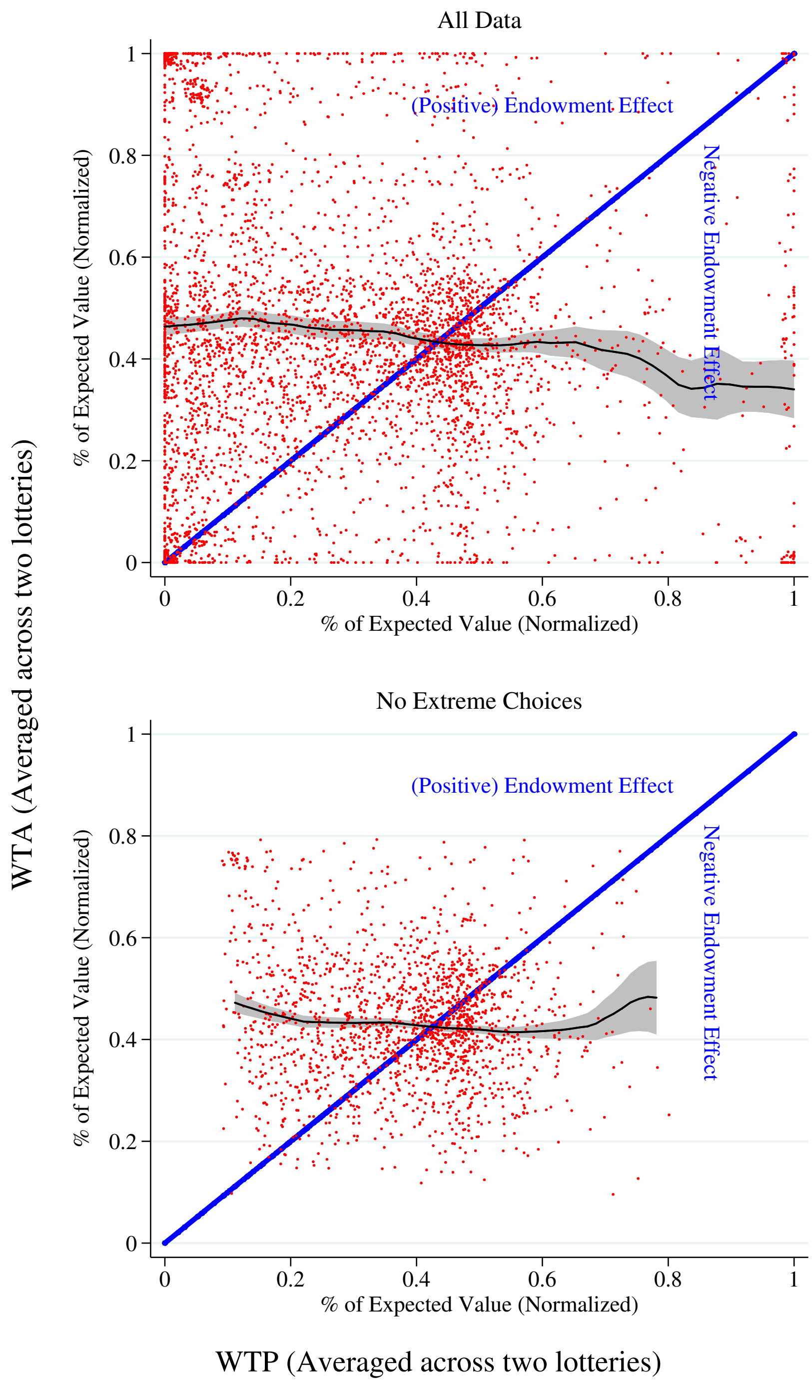
A broader question is whether a model of reference-dependent preferences with offsetting changes in u and λ is the correct explanation for the zero correlation between WTA and WTP. The fundamental idea of these models is that the endowment effect is due to loss aversion. At the same time, loss aversion should also manifest itself as an increase in risk aversion for lotteries that involve both gain and losses—the original definition of the phenomenon (Kahneman and Tversky, 1979). Thus, the former should be highly correlated with the latter. We can test this prediction using our data.

Data and Design. The data in this paper come from three studies, comprised of four surveys, summarized in Section 3. The first study includes 2,000 participants, 1,465 of which also participated in a second survey six months later. The second and the third include 1,000 participants each, for a total of 4,000 participants. All surveys were incentivized and run on representative samples of U.S. adults by the survey company YouGov. In addition to questions about WTA and WTP, our surveys included questions aimed at capturing other aspects of preferences—including risk preferences and loss aversion.

Results. Our key finding is that WTA and WTP are, at best, very weakly related with each other. This is shown graphically in Figure 1. This figure shows the average WTA from two lotteries on the vertical axis, and average WTP on the horizontal axis, for all 4,000 participants in our data. The 45-degree line separates those exhibiting a positive endowment effect from those exhibiting a negative one.[5] The figure also displays a non-parametric fit of the data with 95% confidence intervals. In the second panel, we show that the patterns do not change when eliminating all extreme answers.

[5]This excludes Wave 2 of Study 1, as these are repeated observations of participants from Wave 1. All results are shown separately by survey in Chapman, Ortoleva, Snowberg, Dean, and Camerer (2017). A histogram of the endowment effect underlying these figures is shown in Appendix Figure A.2.

Figure 1: WTA and WTP are uncorrelated, even after removing dominated choices.



Notes: Axes represent the average WTA and WTP for two lotteries. WTA and WTP for each lottery is measured as the percent of the expected value, normalized to [0,1], and is displayed with a small amount of jitter. The lower panel excludes anyone who switched in the top or bottom three rows of the MPL for any of the four lotteries.

Like prior studies, Figure 1 shows that the majority of participants exhibit an endowment effect: that is, the majority of points lie above the 45-degree line, as we discuss extensively in Section 4.1.[6]

We provide evidence that our findings are not just due to measurement error. We first examine, in Section 4.2, the correlation between WTA and WTP using an approach that provide consistent estimates even in the presence of measurement error, and consistently find the same relationship. We also document that the correlations between our two measures of WTA and our two measures of WTP are quite large, and that if we examine the within-participant stability of WTA and WTP over six months, these measures are as stable as other measures of risk and time preferences.

Our findings extend to another approach to eliciting WTA and WTP, as described in Section 4.4. Sprenger (2015) treats the fixed option in a Multiple Price List (MPL) as the endowment. Consistent with this approach, we find that measures of risk preferences in which a monetary amount is the fixed element of the MPL are correlated with WTP, while those in which a lottery is the fixed element are correlated with WTA. This provides further evidence that our WTA and WTP measures are not driven only by noise. Further, these two clusters of risk preferences are not correlated with each other, generalizing our main result to the case in which reference points are implicit, rather than explicit.

The Endowment Effect and Loss Aversion. Finally, in Section 4.5, we test our last theoretical prediction: that loss aversion for risky choices that include both gains and losses is related to the endowment effect. Our surveys contain two ways to measure loss aversion in risky choice: a simple lottery equivalence task, and the Dynamically Optimized Sequential Experimentation (DOSE) approach of Chapman, Snowberg, Wang, and Camerer (2019). In Section 4.5, we find that the correlation between these measure and the endowment effect is small and statistically indistinguishable from zero across a number of different specifications. This rules out any formulation of prospect theory that uses the same notion of loss aversion to explain risky choices and the endowment effect. Thus, the only way to reconcile this finding with theories of reference-dependent preferences is to assume two different parameters governing loss aversion, one for monetary lotteries of gains and losses, the other for buying

[6]In that same section we also discuss the fact that a substantial minority of participants having a negative endowment effect—that is, lying below the 45-degree line—is consistent with the few previous studies that have within-participant measures of the endowment effect, summarized in Appendix B.

and selling lottery tickets.

Alternative Theories. The literature in economics and psychology suggests many alternative models of the endowment effect that do not rely on loss aversion. In the penultimate section, Section 5, we discuss some of the theories that can accommodate our findings. Reference dependence may derive from incomplete (or imprecise) preferences, to which individuals react with either inaction or caution. Broadly speaking, individuals may be unsure how to compare an object with monetary amounts in a given range, and choose neither to sell, nor purchase, in these cases. Alternatively, the endowment effect may be due to reference prices: when selling agents may not want to receive less than what they believe is the market, or reference, price, even when their own value for the object is lower. All these models lead to an endowment effect, and can easily accommodate unrelated WTA and WTP, as in our data. Other approaches link the endowment effect to differential information processing during buying or selling, which connects with evidence in neuroscience suggesting that different cognitive processes may be involved. All of these approaches generate the endowment effect via mechanisms unrelated to, and potentially independent of, loss aversion for risk. They are thus more naturally compatible with our finding that loss aversion and the endowment effect are unrelated.

2 Theory: Models of Reference-Dependent Preferences

This section examines the consequences of a near-zero correlation between WTA and WTP for theories of reference-dependent preferences. We show that a zero correlation is consistent with these models for specific parameterizations that rule out some popular formulations. In addition, our theoretical exploration suggests additional tests of models of reference-dependent preferences that we can implement using independent measures of loss aversion.

What is the Reference Point? The endowment effect is inconsistent with the standard theory of utility maximization, in which WTA and WTP coincide (up to measurement error and income effects). It is also known, although possibly less appreciated, that the endowment effect is inconsistent with certain theories of reference-dependent preferences. Reference points based on a fixed monetary amount (typically zero, as in Kahneman and Tversky, 1979), the expected value of the lottery (as in Bell, 1985; Loomes and Sugden, 1986), or generated through some process of rational expectation (as in the unacclimating personal equilibrium and the personal preferred equilibrium versions of the model of Kőszegi and Rabin 2006) do not imply a change in reference points between the WTA and WTP frames. Thus, these formulations predict that the two measures should be the same, leaving no room for an endowment effect.

As such, we focus on models in which the reference point changes between the buying and selling frame. Specifically, we assume the reference point is the monetary endowment in WTP, and the lottery to be sold in WTA. This is consistent with the original model linking prospect theory and the endowment effect in a riskless setting (Tversky and Kahneman, 1991), as well as the "first focus" variant of Kőszegi and Rabin (2006).

2.1 A Model of Reference-Dependent Choice

Models of reference-dependent preferences vary in the structural way in which reference points are incorporated. We first discuss the implications of a baseline specification, and towards the end of each subsection discuss how our findings generalize. In our baseline specification, individuals view selling a lottery for an amount y as a transaction in which they gain y but lose the value of the lottery—acting as if they are endowed with the lottery. Individuals view buying a lottery for an amount z as a transaction in which they gain the lottery but lose an amount z compared to the reference point of their monetary endowment. We also assume that monetary outlays to buy the lottery are encoded as a loss (see Bateman, Kahneman, Munro, Starmer, and Sugden, 2005, for evidence in support of this approach). Our baseline approach is similar to the way the endowment effect is modelled in riskless choice, treating the lottery in a similar manner to a mug or pen in classic experiments (for example, Tversky and Kahneman, 1991). An alternative is to use the approach of Kőszegi and Rabin (2007) to directly model an endowment effect for risk. Both lead to similar conclusions, as we show in Appendix C.

Individuals are assumed to have a utility $u(x)$ over gains. The utility over losses is given by $-\lambda u(-x)$ for $x < 0$ with λ capturing loss aversion. For ease of exposition, we focus on a utility function that exhibits Constant Relative Risk Aversion (CRRA): $u(x) = x^\alpha$ for $x > 0$ and $\alpha > 0$.

The value of selling a lottery for an amount y is the sum of the utility of the monetary gain of y minus the loss of the lottery. WTA is the y that makes the value of this transaction equal to zero—that is, the value of not selling and remaining at the reference point. Similarly, buying a lottery for an amount z involves the utility associated with a loss of z, plus the gain of the value of the lottery. WTP is the z that makes the value of this transaction equal to that of not buying—once again, zero. Denoting by $V := 0.5u(h) + 0.5u(l)$, the expected utility of a 50/50 lottery between $h > 0$ and $l > 0$ we obtain:[7]

$$-\lambda \text{WTP}^{\alpha} + V = 0 \qquad\qquad \text{WTA}^{\alpha} - \lambda V = 0$$
$$\text{WTP} = V^{1/\alpha}/\lambda^{1/\alpha} = \hat{V}/\hat{\lambda} \qquad\qquad \text{WTA} = \lambda^{1/\alpha}V^{1/\alpha} = \hat{\lambda}\hat{V}$$

in which $\hat{\lambda} := \lambda^{1/\alpha}$ and $\hat{V} = V^{1/\alpha}$. These terms are easily interpreted: $\hat{V}$ is the certainty equivalent of the lottery absent any reference effects, while $\hat{\lambda}$ captures the impact of loss aversion in monetary terms—hence the adjustment with α. In particular, there is no impact on WTA or WTP when $\lambda = 1 = \hat{\lambda}$, that is, when there are no reference effects.

Below, and in Appendix C, we consider alternative assumptions, such as not encoding monetary expenditure as a loss, using the structure implied by the Kőszegi and Rabin (2007) model, and alternative utility functions. Broadly speaking, these alternative models will lead to the same conclusions.

2.2 The Correlation between WTA and WTP

We now turn to our main focus of interest: the correlation between WTA and WTP:

$$\text{corr}(\text{WTA}, \text{WTP}) = \frac{\text{cov}(\text{WTA}, \text{WTP})}{\sqrt{\text{var}(\text{WTA})\text{var}(\text{WTP})}} = \frac{\mathbb{E}[\hat{V}^2] - \mathbb{E}[\hat{\lambda}\hat{V}]\mathbb{E}[\hat{V}/\hat{\lambda}]}{\sqrt{\text{var}(\text{WTA})\text{var}(\text{WTP})}}$$

Assuming finite variances for both WTA and WTP, then:

$$\text{corr}(\text{WTA}, \text{WTP}) = 0 \quad \Leftrightarrow \quad \mathbb{E}[\hat{V}^2] - \mathbb{E}[\hat{\lambda}\hat{V}]\mathbb{E}[\hat{V}/\hat{\lambda}] = 0 \quad \Leftrightarrow \quad \text{var}(\hat{V}) = \mathbb{E}[\hat{\lambda}\hat{V}]\mathbb{E}[\hat{V}/\hat{\lambda}] - \mathbb{E}[\hat{V}]^2 \tag{1}$$

where the last implication is obtained by adding $-\text{var}(\hat{V}) = \mathbb{E}[\hat{V}]^2 - \mathbb{E}[\hat{V}^2]$ to both sides.

Thus, we have a zero correlation between WTA and WTP if and only if $\text{var}(\hat{V})$, the variance of the reference-free values of the lottery, is offset by the additional variation in the

[7] The assumption of expected utility is not essential. We only need that λ is not involved in computing the value of a lottery that pays only non-negative amounts.

value of the lottery due to $\hat{\lambda}$, $\mathbb{E}[\hat{\lambda}\hat{V}]\mathbb{E}[\hat{V}/\hat{\lambda}] - \mathbb{E}[\hat{V}]^2$. This term is weakly positive, and equal to zero if and only if $\text{var}(\hat{\lambda}) = 0$.[8] Thus, a zero correlation between WTA and WTP implies that the variance in the underlying valuation of the lottery is perfectly offset by the variation in valuation due to loss aversion. Moreover, as we will rule out the possibility that variation in WTA and WTP is only due to measurement error, this implies that both $\text{var}(\hat{V}) > 0$ and $\text{var}(\hat{\lambda}) > 0$. To see why, note that if one variance is zero, then to satisfy (1) the other must be as well. This would imply that there would be no variation in the underlying value of either WTA or WTP, which is easily falsified.

These implications also hold in the presence of idiosyncratic, additive measurement error. In this case, the covariance of measured WTA and WTP is equal to the covariance of the underlying values. If the variances of measured WTA and WTP are finite, the correlation between the two measures will be zero if and only if (1) holds. Additionally, our empirical analysis makes use of ORIV estimators, discussed in Section 3.2, which give consistent estimates even in the presence of measurement error.

The implication of (1) can be made even more explicit by considering the correlation between logged values of WTA and WTP, which is also zero in our data (see Table 3). As $\log(\text{WTA}) = \log \hat{V} + \log \hat{\lambda}$ and $\log(\text{WTP}) = \log \hat{V} - \log \hat{\lambda}$, then:

$$\text{cov}(\log(\text{WTA}), \log(\text{WTP})) = \text{var}(\log \hat{V}) - \text{var}(\log \hat{\lambda}).$$

A zero correlation between logged values implies $\text{var}(\log \hat{\lambda}) = \text{var}(\log \hat{V})$. That is, in log terms, the variance of the value of the lottery must equal the variance of the loss aversion component.

Implications for Models of Reference-Dependent Preferences. The results above imply that models of reference-dependent preferences can be made consistent with a zero correlation between WTA and WTP, or, indeed, any correlation between the two. However, the fact that that we observe a (near) zero correlation has two important implications for such models, both of which stem from (1).

First, a zero correlation rules out the popular model in which utility over small stakes is linear, and all deviations from expected value maximization are driven primarily by loss

[8]This is immediate if $\hat{\lambda}$ is a constant. The other direction follows from Jensen's inequality.

aversion (see, among many, Rabin and Thaler, 2001; Kőszegi and Rabin, 2009; Gächter, Johnson, and Herrmann, 2007). If utility over small stakes were linear, this would imply $\text{var}(\hat{V}) = 0$, and, as the variance of $\hat{\lambda}$ cannot also be zero, a negative correlation between WTA and WTP—not the zero correlation we find.[9]

Second, a zero correlation implies that the "behavioral" factor determining the value of the lottery—loss aversion—is as important as the "standard" factor—expected utility—in terms of the variation they induce in the valuation. This implies that our data is incompatible with a world view in which behavioral factors are second order relative to the standard drivers of economic choice.

Beyond our Baseline Specification. There are two obvious extensions to consider: functional form, and what happens when individuals do not encode monetary payments as a loss. It is straightforward to see how our results can be generalized beyond CRRA. For a generic utility function u, $\text{WTA} = u^{-1}(\lambda V)$ and $\text{WTP} = u^{-1}(\frac{V}{\lambda})$. If the difference of the curvature of u^{-1} from CRRA has a second-order effect, we obtain a multiplicative form similar to the one derived for CRRA, and thus the same conclusions. This seems likely, as WTA and WTP are often relatively close. We formalize this argument in Appendix C.

If individuals do not encode monetary payments as a loss, then $\text{WTP} = \hat{V}$, and so $\text{cov}(\text{WTA}, \text{WTP}) = \text{var}(\hat{V}) + \text{cov}(\hat{V}, \hat{\lambda})$. Such a model can still be consistent with a zero correlation between WTA and WTP if $\text{var}(\hat{V}) = -\text{cov}(\hat{V}, \hat{\lambda})$. Our broad implications continue to hold in this case. As before, we can rule out the case of no variation in the underlying value of the lottery—as WTP would be only noise, which we readily reject. We can further rule out the implication that the variance in $\hat{\lambda}$ is unimportant relative to variance in $\hat{V}$—in which case we should see a positive correlation between WTA and WTP.

2.3 Direct Measures of Loss Aversion and Additional Tests

As the models of reference-dependent preferences described above are consistent with a zero—or indeed any—correlation between WTA and WTP, a dataset including only these measures offers no possibility of falsification. However, such tests can be performed using our

[9]In practice, we find a weakly negative correlation between WTA and WTP in several specifications. In principle, a negative correlation may be consistent with linear utility. However, the magnitude of this correlation is very small, which can be reconciled with linear utility only if we had very high measurement error. But this is inconsistent with the very high correlation between different measures of WTA or WTP.

dataset, as it includes alternative ways of estimating loss aversion. The original definition of loss aversion—and still one of its key signatures—is an increase in risk aversion for lotteries that involve both gains and losses relative to those that involve gains alone or losses alone Kahneman and Tversky (1979). We refer to this phenomenon as *loss aversion for risk* to distinguish this from other (potential) forms of loss aversion.

Our data provides two ways to measure loss aversion for risk. The first measures, from Dynamically Optimized Sequential Experimentation (DOSE), estimates λ and α using a sequence of questions, and is described more thoroughly in Section 3.3.

The second elicits the amount $c < 0$ that makes the agent indifferent between 0 and a lottery that pays $y > 0$ or c with equal probability—a standard way to elicit loss aversion for risk. Assuming that individuals treat 0 as the reference point, c is increasing in loss aversion.[10] Our baseline specification implies:

$$\frac{1}{2}y^{\alpha} - \frac{1}{2}\lambda(-c)^{\alpha} = 0 \quad \Leftrightarrow \quad \hat{\lambda} = \lambda^{1/\alpha} = -\frac{y}{c}.$$

As y is constant, it follows that the inverse of c is perfectly negatively correlated with $\hat{\lambda}$.

Assuming a unified approach to loss aversion—that is, the same loss aversion parameter governs both the increase in risk aversion for mixed lotteries and the endowment effect—and using the ratio of WTA to WTP as a measure of the endowment effect we have:

$$\frac{WTA}{WTP} = \frac{\hat{\lambda}\hat{V}}{\hat{V}/\hat{\lambda}} = \hat{\lambda}^2.$$

Thus, in our baseline model $-1/c$ should be perfectly correlated with $\sqrt{\frac{\text{WTA}}{\text{WTP}}}$.

These results extend beyond CRRA and the specific form of reference dependence adopted. Indeed, at the heart of models with a unified notion of loss aversion is a substantial correlation between the endowment effect and loss aversion for risk. Note that even if monetary expenses are not encoded as losses, we have $\frac{\text{WTA}}{\text{WTP}} = \frac{\hat{\lambda}\hat{V}}{\hat{V}} = \hat{\lambda}$. Thus, $-1/c$ should be perfectly correlated with $\frac{\text{WTA}}{\text{WTP}}$. Similar results hold approximately for CARA utility, as shown in Appendix C. More broadly, for any generic utility function u and any form of prospect theory, increasing loss aversion increases c. Similarly, in any form of prospect theory that

[10]This is implied both by classic versions of prospect theory, such as (Kahneman and Tversky, 1979), or by the approach used, for example, in (Sprenger, 2015), in which the fixed option, in this case 0, in a multiple price list acts as the reference point.

generates an endowment effect, the endowment effect is also increasing in loss aversion—this is key to models that generate the endowment effect from loss aversion. It follows that for any reference-dependent model with a unified approach to loss aversion, we should observe a positive correlation between loss aversion for risk, c, and the endowment effect, controlling for risk aversion. This drives the tests in Section 4.5.

3 Design and Data

Our data come from four representative surveys of U.S. adults conducted online by YouGov, which are summarized in Table 1.[11] All four surveys were incentivized: participants were paid based on outcomes associated with their choices. Two choices were selected for payment after the participant completed the entire survey.[12] All outcomes were expressed in points, an internal YouGov currency. Points can be converted to U.S. dollars, or prizes, at the rate of approximately $0.001 per point. While the four studies varied in their particulars, the median completion time was around 40–45 minutes, and the average payment to participants (including a 3,000 point show-up fee) was around $11 (11,000 points). This compensation level is quite high for an internet survey, and represents a rate of pay approximately three times the average for YouGov surveys.

The first study consisted of two waves conducted about six months apart. The initial wave contained 2,000 participants, all of which were recontacted, although only 1,465 participated in the second wave.[13] Study 2 and 3 were run on independent, 1,000-person representative

[11]YouGov maintains a panel of participants and continually recruits new people, especially from hard-to-reach and low-socio-economic-status groups. To generate a representative sample, YouGov randomly draws people from various Census Bureau products, and matches them on observables to members of its panel. Differential response rates lead to the over-representation of certain populations. Thus, YouGov provides sample weights to recover estimates that would be obtained from a fully representative sample. According to Pew Research, YouGov's sampling and weighting procedure yields better representative samples than traditional probability sampling methods with non-uniform response rates, including Pew's own probability sample (Pew Research Center, 2016, YouGov is Sample I). We use these weights throughout the paper, including when assessing the percentage of participants with a certain response or trait. Unweighted results can be found in the Appendix of the working paper version (Chapman, Ortoleva, Snowberg, Dean, and Camerer, 2017).

[12]This is incentive compatible under Expected Utility, but not necessarily under more general risk preferences, where no such mechanism may exist (Karni and Safra, 1987). A growing literature suggests this theoretical concern may not be empirically important (Beattie and Loomes, 1997; Cubitt, Starmer, and Sugden, 1998; Hey and Lee, 2005; Kurata, Izawa, and Okamura, 2009), but there are some exceptions (Freeman, Halevy, and Kneeland, 2015).

[13]The attrition rate of $\sim 25\%$ is lower than most online surveys. This is due, in part, to YouGov's panel management, and in part to the large incentives we offered. A simple regression of a dummy variable for

Table 1: Details of Studies

	Dates	N	Lotteries for WTA and WTP	Avg. Time (minutes)	Avg. Pay (points)
Study 1					
Wave 1	Mar. 27–Apr. 4 2015	2,000	$0.5 * 0 \oplus 0.5 * 10{,}000$ $0.5 * 2{,}000 \oplus 0.5 * 8{,}000$	40 (median) 54 (mean)	8,000 (median) 8,336 (mean)
Wave 2	Sep. 21–Nov. 23 2015	1,465	$0.5 * 0 \oplus 0.5 * 10{,}000$ $0.5 * 2{,}000 \oplus 0.5 * 8{,}000$	37 (median) 56 (mean)	8,000 (median) 8,532 (mean)
Study 2	Mar. 30–Apr. 14 2016	1,000	$0.5 * 1{,}000 \oplus 0.5 * 9{,}000$ $0.5 * 2{,}000 \oplus 0.5 * 8{,}000$	46 (median) 70 (mean)	8,500 (median) 9,014 (mean)
Study 3	Feb. 21–Mar. 24 2020	1,000	$0.5 * 1{,}000 \oplus 0.5 * 9{,}000$ $0.5 * 2{,}000 \oplus 0.5 * 8{,}000$	43 (median) 55 (mean)	6,000 (median) 7,069 (mean)

Notes: Lotteries are denoted by probabilities of each prize times the size of the prize, separated by $\oplus$.

samples. These studies changed one of the lotteries we used to elicit WTA and WTP, as well as adding other risk aversion measures for further hypothesis testing. Details of these surveys are found below, and screenshots of the choices we analyze in this paper can be found in Online Appendix B.[14]

3.1 Measuring WTA and WTP

Each study contained incentivized measures of WTA and WTP for two different lottery tickets. This allows a *within*-participant design, which is necessary for measuring the correlation between WTA and WTP. Using two lottery tickets allows us to correct for measurement error, as discussed in Section 3.2.

Each elicitation is performed using a multiple price list (MPL; Holt and Laury, 2002),[15] which consists of a table with two columns of outcomes. In each row, the participant is asked to make a choice between the outcomes in the columns. One column contains the same

attrition on individual demographics suggests that participants who were male, non-white, or in the oldest age quartile were more likely to drop-out (the estimated increase in drop-out rate was 4%, 7%, and 10% for the respective groups). However, if this regression is performed with YouGov's sample weights, described in Footnote 11, then there are no statistically-significant relationships between demographics and attrition.

[14]Complete design documents and screenshots can be found at eriksnowberg.com/wep.html, and will be included in replication data accompanying the paper.

[15]The MPL is generally considered easier to explain to participants than, for example, incentivized pricing tasks (see, for example, Cason and Plott, 2014).

outcome in all rows, while outcomes in the other column vary, becoming more attractive as one moves down the table. Participants who understand the question should choose the former option for early rows, and at some point switch to choosing the latter (varying) option. In all rows below that point, the participant should also choose the latter option.[16] We use as our measure the average value of the varying option over the two rows where the participant's choices switched columns; using the minimum or maximum value leads to similar results. The first and the last row of the MPL always involves a dominated option—for example, 2,000 points or a lottery that pays 2,000 or 8,000 with equal probability—with the undominated option pre-selected.[17]

The elicitation of WTA had the following form:

> For this question, you are given a lottery ticket that has a 50% chance of paying you 10,000 points, and a 50% chance of paying you 0 points. You have two options for this lottery ticket:
>
> - Keep it or
> - Sell it for a certain amount of points (for example, 2,000 points).

Participants were then asked "For each row in the table below, which option would you prefer?" and were presented with an MPL with the option "The Lottery Ticket" and the option "Sell it for x points," where x changed with the row.

For WTP, the same lottery tickets were used, but participants were told instead:

> For this question, you have been given 10,000 points. You will be offered the opportunity to exchange some of these points for a lottery ticket. This lottery ticket has a 50% chance of paying you 10,000 points, and a 50% chance of paying 0 points.
>
> For example, if you choose to pay 1,000 points for a lottery ticket, and this question is chosen for payment, you will:

[16] Participants were not allowed to proceed if there were multiple switches in their choices.

[17] We used the same range for WTA and WTP questions to avoid confounds due to range effects (Beauchamp, Benjamin, Chabris, and Laibson, 2012; Mazar, Koszegi, and Ariely, 2014). To identify participants that chose dominated options without carefully reading the question, we added an additional feature to the choices in Studies 2 and 3. We included *two* dominated options at the top and bottom of each MPL. One was pre-selected, consistent with Study 1. The second could be chosen (or not) by participants. If participants chose a dominated option in Study 2, they were alerted to this. For WTA and WTP, 36% of those alerted to a dominated choice chose to go back, and the proportion of participants eventually selecting a dominated option was between 15 and 21% across the four elicitations. This rate is consistent with the proportion of student participants failing "attention screeners" in a lab setting (Snowberg and Yariv, 2021). Omitting those that made a dominated choice on any of the four WTA/WTP questions does not affect our results, see Figure 1 and Appendix Table A.1.

- Pay 1,000 points for the lottery ticket;
- Keep 9,000 points for yourself; and
- Earn whatever proceeds you get from the lottery ticket (if any).

Participants were shown an MPL with the options "Keep 10,000 points" and "Buy the lottery ticket for $(10,000 - x)$ points and keep the remaining x points", with x varying by row. If one of the WTA or WTP questions was randomly chosen for payment, a single line would then be selected at random, and the choice of the participant in that line would then be implemented to determine their payoff. Screenshots for these questions can be found in Online Appendix Figures B.1–B.4.

In each study, two lottery tickets with different payoffs were used to elicit WTA and WTP, as shown in Table 1. Both waves of Study 1 used the same lotteries. Studies 2 and 3 used one lottery from Study 1, and a new lottery that eliminated the zero payoff in the second lottery of Study 1. All lotteries had the same expected value (5,000 points). Except where noted, our measure of the endowment effect is WTA$-$WTP for the same lottery.

The ordering of questions in each study was randomized to reduce consistency bias, with one of WTA or WTP randomly chosen in one of the first question slots, and the other in one of the last question slots.[18] The average WTA, WTP, and endowment effect are the same regardless of whether WTA was randomly selected to appear before WTP, or WTP before WTA. As shown in Appendix Table A.1, our key result, the correlation between WTA and WTP, is also independent of question ordering.

The elicitation of WTA and WTP above explicitly uses the language of buying and selling, in line with the literature (see, for example, Isoni, Loomes, and Sugden, 2011). Another line of research, including Sprenger (2015), uses the framing implicit in MPLs to manipulate reference points and elicit the endowment effect. In Section 4.4, we use Sprenger's approach, and data from other risk elicitations in Study 2, to show that our results are robust to this design choice.

3.2 Measurement Error and ORIV

[18]For details, see Appendix C. Note that a consistency bias would tend to produce a positive correlation between WTA and WTP.

A common concern with statistically-insignificant findings is that they are caused by attenuation bias due to measurement error. Eliciting WTA and WTP for two lotteries for each participant allows us to substantially reduce this concern. We approach this in two ways.

First, we can average together the two measures of WTA and WTP. This reduces, but does not eliminate, attenuation due to measurement error. The estimate of the correlation may be both biased and inconsistent, although it is easier to visualize in figures, such as Figure 1.

Second, we can use the obviously-related instrumental variables (ORIV) technique of Gillen, Snowberg, and Yariv (2019). This adapts an errors-in-variables instrumental variables (IV) approach, and produces consistent estimates of correlations. The main difficulty with using a standard IV approach with our data is that each quantity measured is equally valid as a left- or right-hand-side variable. Moreover, for a given right-hand-side variable, either observation could be the instrument or the instrumented variable. In essence, ORIV stacks all four possible IV regressions in order to maximize the information in the estimate, and then applies adjustments to the regression coefficient in order to obtain a consistent estimate of the correlation, and to ensure that standard errors are calculated efficiently. We refer the interested reader to Gillen, Snowberg, and Yariv (2019) for details.

3.3 Other Measures

Each of the three studies contains various other measures of economic behavior. We describe those used in this paper below.

Study 1 was designed to measure a broad range of economic behaviors in several waves. In addition to WTA and WTP, it includes measures of a large number of other preferences, such as time preferences, distributional preferences, lying costs, and so on. Some of these measures are used to benchmark the time stability of WTA, WTP, and the endowment effect in Section 4.3.

This study also used Dynamically Optimized Sequential Experimentation (DOSE, Chapman, Snowberg, Wang, and Camerer, 2019) to elicit parameters of the CRRA utility function—loss aversion (λ) and utility curvature (α)—for choices between lotteries. DOSE presents participants with a series of binary choices between a lottery and a sure amount. The sure amounts and the prizes in the lotteries are chosen to maximize the informativeness of the choice for the parameters of interest (in this case λ and α) given a flat prior over those parameters. This prior is updated after each choice, and a new question is chosen, until 10 questions have been asked. Some of these questions contain lotteries with gains only, which help to pin down α, while others contain lotteries with both gains and losses which help to pin down λ, conditional on α.[19] In Section 4.5, DOSE-estimated parameters are used to test theoretical predictions about WTA, WTP, and the endowment effect.

Study 2 also provides a number of alternative measures of risk attitudes, used in Section 4.4. As with WTA and WTP, all questions were elicited twice, with different lotteries, in order to control for measurement error.

These risk measures fall into two broad categories. The first uses varying monetary amounts to identify the certainty equivalent of a fixed risky prospect—we refer to these as fixed lottery measures. This category contains four measures that vary in terms of the domain—gains, losses, or both—over which risk is measured, or in the way that randomization in the lottery is conducted—with a lottery ticket, or with a draw from an urn:

Gain: A lottery where one payoff was a small gain (or zero), and the other a large gain. An example is eliciting the certainty equivalent of a 50% chance of 5,000 points and a 50% chance of zero points, as shown in Online Appendix Figure B.9.

Mixed: A lottery where one payoff was a moderate gain, and one was a moderate loss. Participants could choose between these lotteries and sure losses/sure gains. An example is eliciting a certainty equivalent of a lottery with a 50% chance of winning 5,000 points and a 50% chance of losing 5,000 points, as shown in Online Appendix Figure B.13.

Loss: A lottery where one payoff was a small loss (or zero), and the other was a large loss. Participants could choose between these lotteries and sure losses. An example is eliciting the certainty equivalent of a lottery with a 50% chance of 0 points, and a 50% chance of *losing* 5,000 points, as shown in Online Appendix Figure B.11.

Urn: This measures the certainty equivalent for a draw from an urn with an equal number

[19] We use the preferred model in Chapman, Snowberg, Wang, and Camerer (2019), but others are possible: for example, one that models choices in a KR framework. The authors of the DOSE paper have attempted this, and found that the versions of the KR model they tried are badly misspecified: the parameter estimates fit far fewer choices than the model used here. Indeed, the KR models tend to fit around 50% of choices, close to the score one would obtain by guessing randomly.

of two colors of balls, one representing a large payoff, and the other a zero payoff. An example is eliciting the certainty equivalent of a gamble based on an urn with 50 brown and 50 blue balls, which pays 10,000 points if a brown ball is drawn, and zero otherwise, as shown in Online Appendix Figure B.7.

The second category contains two types that vary the prizes in a lottery in order to elicit indifference to some other prospect—we call these "variable lottery"' measures:

FM: The monetary amount is fixed (FM = fixed money), and participants choose which lotteries (with fixed probabilities but a variable prize) they prefer over this amount. An example is eliciting the value x that makes a participant indifferent between 2,500 points for sure and a 75% chance of x points and a 25% chance of 0 points, as shown in Online Appendix Figure B.15.

2L: In these questions, the fixed prospect is a specific lottery, and the participants choose which of the variable lotteries (with fixed probabilities) they prefer over this fixed lottery (2L refers to "two lotteries"). An example is eliciting the value x that makes a participant indifferent between a 25% chance of 2,500 points and a 75% chance of zero points and a 20% chance of x points and an 80% chance of 0 points, as shown in Online Appendix Figure B.17.

Finally, Study 2 also asked participants for their qualitative self-assessment of their own risk attitudes, as in Falk, Becker, Dohmen, Huffman, and Sunde (2013). The question reads: "How do you see yourself: are you a person who is generally willing to take risks or do you try to avoid taking risks?", and asked participants to rate themselves from 0 to 10, as shown in B.21.

Study 3 was designed to measure a more limited range of behaviors, in order to allow direct tests of the theoretical relationships between various measures of the endowment effect and loss and risk aversion. In particular, it contained WTA, WTP, DOSE measures of risk and loss aversion, the gain, mixed, and loss elicitations of risk preferences, and an additional measure designed specifically to fit the theory in the prior section. Specifically, we included an additional variable lottery measure:

FM–Mixed: This is similar to the FM measure in that the lottery amount is fixed, and participants choose which lotteries (with fixed probabilities but a variable prize) they prefer over this amount. In FM–Mixed, however, the fixed amount is zero, and the lottery consists of a fixed positive amount y and a varying negative amount c with equal probabilities. The MPL therefore elicits the c such that the subject is indifferent between gaining y and losing c with equal probability, and getting zero for sure,

4 Results

We now turn to describing our results. We begin by showing that most of our participants display an endowment effect, in line with existing findings, before moving to our core empirical result: the limited correlation between WTA and WTP. As a way to obtain such a correlation would be for our measures to be primarily noise, we use the repeated survey in Study 1, and a number of other methods, to show that this is not the explanation for our core finding. We then show that the primary principle organizing the risk measures described in Section 3.3 is whether they are framed (implicitly or explicitly) as buying or selling a lottery. Finally, we test the theoretical prediction, discussed in Section 2, that the endowment effect should be positively correlated with other measures of loss aversion.

4.1 The Endowment Effect

Consistent with existing research, most participants in our data exhibit an endowment effect (that is, WTA > WTP). This was already clear from Figure 1 in the Introduction; Table 2 shows more precise descriptive statistics. Overall, the distribution of the endowment effect is consistent across surveys: approximately 60% of participants exhibit an endowment effect, 10% exhibit no endowment effect, and about 30% exhibit a negative effect. These figures are in line with the few previous within-participant estimates, which we have collected and analyzed in Appendix B.[20] Across our studies, the average WTA was 90% of the expected value of the lottery (median 88%, s.d. 37%), while the average WTP is statistically significantly lower at 68% (median 66%, s.d. 33%).

[20]The discrete nature of the MPL elicitations does not allow us to distinguish between subjects with small positive, small negative, or no endowment effect. The results in Table 2 assume a valuation that is the midpoint of the certainty equivalents on either side of the MPL switch. Alternative codings produce somewhat different results. Changing how this is calculated can reduce the percentage of subjects with a negative endowment effect to 15–29%, depending on the lottery and study.

Table 2: The endowment effect exists for a majority of participants in our data.

			Lottery 1	
	N	WTA<WTP	WTA=WTP	WTA>WTP
Study 1, Wave 1	2,000	32%	12%	57%
Study 1, Wave 2	1,465	30%	13%	57%
Study 2	1,000	28%	12%	59%
Study 3	1,000	34%	9%	56%
			Lottery 2	
	N	WTA<WTP	WTA=WTP	WTA>WTP
Study 1, Wave 1	2,000	25%	15%	61%
Study 1, Wave 2	1,465	24%	16%	61%
Study 2	1,000	24%	14%	62%
Study 3	1,000	34%	11%	55%

A negative endowment effect can be reconciled with prospect theory if a participant is loss tolerant, rather than loss averse. There is a growing literature suggesting that a significant fraction of people are, indeed, loss tolerant (Chapman, Snowberg, Wang, and Camerer, 2019; Gal and Rucker, 2018; Goette, Graeber, Kellogg, and Sprenger, 2020). There is additional evidence in our data suggesting that negative endowment effects are not *solely* due to measurement error or random utility. Of those with a negative endowment effect on a single lottery, there is a 65% chance they have a negative endowment effect on the other lottery (removing dominated choices). By comparison, those with a positive endowment effect for one lottery ticket had a 71% chance of having a positive endowment effect for the other. Thus, there seems to be only a bit more noise among participants with a negative endowment effect.

4.2 The (Lack of) Correlation between WTA and WTP

The main empirical finding of this paper—the limited correlation between WTA and WTP—was shown in Figure 1 in the Introduction, and more precise descriptive statistics are shown in Table 3. Two patterns clearly emerge from the data. First, WTA and WTP are not positively correlated. If there is a relationship at all, it is negative, although always small: observing a high willingness to pay for a lottery ticket conveys very little information about willingness to accept. Second, the two measures of WTA are highly correlated with each other, as are the two measures of WTP. Both of these patterns exist in all three of our studies.

The middle two columns of Table 3 take steps to reduce concerns about the role of measurement error in our results. First, we standardize the two lottery measures of WTA, then average them, and do the same for WTP.[21] The correlations between the two resultant measures (in the Averages column) grow slightly more negative, consistent with a reduction in the attenuation bias. Second, we implement the ORIV procedure described in Section 3.2. ORIV produces consistent estimates of correlations, reducing attenuation even further. Again, this does not lead to a positive relation, although statistical power decreases, as ORIV, like all IV techniques, increases standard errors. The final correlation we examine is one that Section 2 highlights, that between the logs of WTA and WTP. Across all four surveys this correlation is statistically indistinguishable from zero.[22]

Examining the data graphically, in Figure 1 in the Introduction, provides additional insight. First, to the extent that there is any correlation between WTA and WTP, it is mostly due to participants with above risk-neutral values expressed for WTP. As this describes only ∼25% of participants, this negative relationship is weak, as indicated by the expanding standard errors. Second, there is wide variation in both WTA and WTP, including participants that give extremely high or low values for WTA and/or WTP. Third, the lack of correlation is not driven by subjects who make "extreme" choices. The second panel of Figure 1 removes those who made dominated choices, or choices next to the dominated options, in any one of the four WTA or WTP elicitations. That panel makes clear that the lack of correlation is not driven by outliers, a finding confirmed statistically in Appendix Table A.1, which shows that the correlation gets closer to zero as more extreme values that are removed.[23]

Other Tests. The Appendix contains two robustness tests. First, in Appendix A, we consider a number of subgroups to assess the consistency of our findings in different subpopulations across age, income, education, measures of IQ, as well as removing outliers, as discussed above. We find low correlations in all 20 subgroups, with one exception: for those

[21] Standardizing these measures implies CRRA utility. This is a reasonable assumption given the small differences in stakes between lotteries.

[22] Online Appendix Table A.1 shows all these relationships for logs of WTA and WTP.

[23] We reproduce this analysis with Spearman correlations in Online Appendix Table A.2. These correlations are generally smaller in magnitude than the Pearson correlations found in Table A.1.

Table 3: Correlations

	Correlation between WTA and WTP					Correlation within Type	
				ORIV			
	Lottery 1	Lottery 2	Averages	Standard	Logs	WTA	WTP
Study 1, Wave 1 (N =2,000)	−0.06* (.037)	−0.06* (.037)	−0.08** (.037)	−0.09** (.044)	0.04 (.051)	0.71*** (.023)	0.74*** (.029)
Study 1, Wave 2 (N =1,465)	−0.01 (.050)	−0.02 (.049)	−0.02 (.054)	−0.02 (.064)	0.09 (.065)	0.67*** (.033)	0.79*** (.022)
Study 2 (N =1,000)	−0.09* (.051)	−0.06 (.056)	−0.09 (.057)	−0.11 (.068)	0.03 (.069)	0.70*** (.034)	0.75*** (.044)
Study 3 (N =1,000)	−0.13** (.057)	−0.12** (.053)	−0.13** (.054)	−0.15** (.066)	−0.05 (.069)	0.75*** (.034)	0.67*** (.057)
All Data (N =4,000)	−0.08*** (.027)	−0.08*** (.027)	−0.09*** (.027)	−0.11*** (.032)	0.02 (.036)	0.72*** (.017)	0.72*** (.023)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, with bootstrapped standard errors from 10,000 simulations in parentheses. Note that as Wave 2 of Study 1 contains a subset of individuals of Wave 1, we do not include it in the "All Data" figures.

who answered all six of the IQ questions correctly, representing the top 5% of the population, the correlation goes as high as 0.32, although including the next 5% of participants in terms of IQ reduces the correlation to around 0.1.

Second, to understand the plausibility of our findings in light of the existing literature, we examine the correlation of WTA and WTP in published studies containing within-person, incentivized measures of the endowment effect for lotteries. These results appear in Appendix B. Only five (total N = 790) have available data. These studies differ from ours in a number of ways, including elicitation methodologies and participant pools. Re-examining these data, we find the correlation between WTA and WTP differs depending on the study, but across all five the average is 0.13—a similar magnitude, although opposite sign, to our data. This is, however, consistent with the correlation in our data for those most similar to lab participants—those with high IQs and post-secondary education—suggesting that the difference between our study and prior work is due to differences in participant populations, rather than methodology. Moreover, it seems that correlations between WTA and WTP are quite meager, even in the lab with university students.

4.3 Our Measures of WTA and WTP are not Just Noise

The theory in Section 2 notes that a possible explanation for the low or zero correlation between WTA and WTP is that one (or both) measures are composed primarily of noise. The primary evidence against this possibility can be found in Table 3, which shows that the two measures of WTA are very highly correlated, as are the two measures of WTP. However, we can provide further evidence consistent with the idea that these measures are capturing real variation in preferences by using the fact that one of our studies (Study 1) was administered twice to the same participants, six months apart.

The over-time stability of our measures of WTA and WTP is comparable to the stability of other measures of preferences. The within-participant over-time ORIV correlation of WTA is 0.33 (.05) and of WTP is 0.34 (.04). These correlations are statistically significantly different from zero, and not significantly different from each other. Other measures of risk aversion, FM and 2L, described in Section 3.3, that were also present in Study 1 had similar over-time correlations. FM had an over-time ORIV correlation of 0.37 (.04) while the same quantity for 2L is 0.33 (.05). This is similar to the stability of measures of risk preferences over approximately the same amount of time in Caltech undergrads (Gillen, Snowberg, and Yariv, 2019).[24] Study 1 also contains two measures of ambiguity aversion with a within-participant over-time ORIV correlation of 0.21 (.06), time preferences with an ORIV correlation of 0.33 (.07), and amount given in the dictator game with an ORIV correlation of 0.50 (.05).

Three other patterns deserve mention. First, perhaps unsurprisingly, the correlations between WTA in one wave and WTP in the other are nonexistent. Second, the endowment effect has a within-participant over-time ORIV correlation of 0.30 (.05). Third, we can examine the correlation between WTA and WTP on the subset of people who appear to have temporally stable preferences—that is, gave the same valuations in both Wave 1 and Wave 2. The 101 participants who gave the same valuation for the first lottery had a correlation between WTA and WTP of 0.10 ($p = 0.30$) for the first lottery (in both waves, as their valuations were the same), and 0.01 ($p = 0.90$) and 0.02 ($p = 0.87$) for the second

[24]Gillen, Snowberg, and Yariv (2019) did not elicit WTA and WTP.

lottery in the first and second waves, respectively. For the second lottery, the sample is 122 participants and correlations are -0.02 ($p = 0.84$) in the second lottery, and 0.04 ($p = 0.70$) and 0.01 ($p = 0.92$) for the first in each wave.

Thus, our measures of the WTA, WTP, and the endowment effect are as stable as other measures of risk preferences. Once again, this suggests that our measures of WTA and WTP are not just noise—yet they are unrelated to each other.

4.4 Relation with Measures of Risk Aversion

Given the lack of correlation between WTA and WTP, a natural question is how these measures are related to the measures of risk preferences described in Section 3.3. An organizing principle for this examination is proposed by Hershey and Schoemaker (1985) and Sprenger (2015)—who suggest that MPL-based risk elicitations are implicitly framed as either WTA or WTP, depending on the fixed option of the MPL—which is treated as an endowment. In particular, in the *fixed lottery* measures—Urn, Gain, Mixed, and Loss—the lottery is fixed on the left-hand side of the MPL, and participants are asked for their certainty equivalent—implicitly, by asking what they will accept for the lottery. Similarly, in FM, the fixed option is an amount of money, and participants are implicitly asked to gauge how much of that they will give up for the lottery. Thus, under this organizing principle, FM is a measure of WTP, and Urn and Gain are measures of WTA.[25]

There are two useful implications that follow from this organizing principle. First, if WTA and WTP are correlated with implicitly framed measures of the same, it would provide further evidence that our measures are not noise. In particular, it would rule out the possibility that our elicitation mechanism had introduced measurement error that is correlated between the two WTA (or WTP) measures, but unrelated to "true" preferences. Second, these measures provide an alternative test of the hypothesis that WTA and WTP are uncorrelated, using an implicit, rather than explicit, framing.

As predicted, an obvious pattern emerges from the correlations between these additional risk preference measures and WTA and WTP: there are two clusters of strongly-related variables, as shown in Table 4. The correlations in this table are arranged to highlight the

[25] Mixed and Loss are also valid measures of WTA, however, as these choices include both negative sure amounts and negative payoffs in the lotteries, it is more difficult to compare these results to our prior ones using these measures.

Table 4: ORIV Correlations between WTA, WTP, and Other Risk Measures, Study 2

			Fixed Lottery					Variable Lottery	
		WTA	Urn	Gain	Mixed	Loss	WTP	FM	2L
Fixed Lottery	Urn	−0.66***					0.07		
		(.042)					(.067)		
	Gain	−0.66***	0.65***				0.04		
		(.051)	(.051)				(.070)		
	Mixed	−0.58***	0.51***	0.60***			0.19***		
		(.054)	(.053)	(.049)			(.069)		
	Loss	−0.27***	0.26***	0.39***	0.65***		0.30***		
		(.076)	(.067)	(.070)	(.056)		(.077)		
Variable Lottery	FM	−0.03	0.05	0.09	−0.14*	−0.19***	−0.45***		
		(.070)	(.066)	(.069)	(.069)	(.075)	(.041)		
	2L	0.12*	−0.17***	−0.13*	−0.21***	−0.15*	−0.28***	0.41***	
		(.071)	(.063)	(.071)	(.073)	(.078)	(.061)	(.061)	
Qualitative		−0.24***	0.18***	0.18***	0.17***	−0.05	−0.15***	0.15***	0.13*
		(.062)	(.058)	(.077)	(.070)	(.089)	(.064)	(.062)	(.065)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level. Each cell in the table is an ORIV correlation with bootstrapped standard errors from 10,000 simulations in parentheses. All measures except WTA and WTP are (re-)coded so that higher values correspond to more risk aversion.

clusters, rather than displayed as a traditional lower-diagonal matrix.[26] One of the clusters contains measures that are framed (implicitly or explicitly) as WTA, and the second cluster contains those that are framed as WTP.[27] The first cluster includes WTA, as well as the fixed lottery measures: Urn, Gain, Mixed, and Loss. The second cluster includes WTP and the variable lottery measures: FM and 2L. These clusters feature large within-cluster correlations, and smaller correlations with measures in the other cluster.[28] This supports the idea that the primary organizing principle for these risk measures is whether a question is framed—implicitly or explicitly—as WTA or WTP, and provides further evidence that our explicit WTA and WTP measures are not just noise.[29]

Table 4 supports the idea that WTA and WTP are unrelated, regardless of whether the framing is implicit or explicit. The correlations between the implicit measures of WTA (Urn and Gain) and WTP (FM) are statistically indistinguishable from zero. This is also true of the correlations between the explicitly-framed WTA measure and the implicitly-framed WTP measures (FM), and between the explicitly framed WTP measure and the two implicitly framed WTA measures (Urn and Gain). Indeed, the only measure that appears to be (somewhat) correlated across the board is the qualitative measure, which does not rely on an MPL, and hence has no explicit or implicit frame.

4.5 Loss Aversion and the Endowment Effect

[26] All measures of risk aversion are coded so that higher values correspond to more risk aversion. Thus, the expected (and usually observed) sign of the correlation between WTA or WTP and these measures is negative.

[27] A principal components analysis confirms these clusters, and suggests relationships with a broad range of other preference measures: this is studied in detail in Camerer, Dean, Chapman, Ortoleva, and Snowberg (2019). One might also approach these multiple measures using a structural analysis, or study the possibility that participants respond to different framing in heterogenious ways. We leave these possibilities to future research.

[28] The fact that theoretically equivalent measures of risk attitudes produce poorly correlated responses is consistent with a large literature. For recent results from the lab or field, see Berg, Dickhaut, and McCabe (2005); Bruner (2009); Crosetto and Filippin (2016); Deck, Lee, and Reyes (2010); Deck, Lee, Reyes, and Rosen (2013); Harbaugh, Krause, and Vesterlund (2010); He, Veronesi, and Engel (2017); Isaac and James (2000); Loomes and Pogrebna (2014); Lönnqvist, Verkasalo, Walkowitz, and Wichardt (2015); Nielsen, Keil, and Zeller (2013). See Weber and Johnson (2008) for a summary of the psychology literature on this topic. Gillen, Snowberg, and Yariv (2019) suggests that findings of low correlations between measures of risk attitudes may be due to measurement error—we adopted its techniques to rule this out.

[29] This interpretation is further supported by the fact that the endowment effect(s) as measured with implicit and explicit framing have an ORIV correlation of 0.54.

As noted in Section 2, the near zero correlation between WTA and WTP is consistent with particular parameterizations of reference-dependent preferences. Assuming a unified notion of loss aversion, these models make an additional prediction: the endowment effect should be correlated with loss aversion in risky choices. This subsection tests that prediction.[30]

One general takeaway from Section 2 is that, in reference-dependent models, the endowment effect is positively correlated with the value c obtained from the FM–Mixed measure. This prediction is core to the approach of modeling the endowment effect as a consequence of loss aversion, and holds across prospect theory specifications and functional forms of the utility function. As a simple, non-parametric test, Figure 2 plots c against a standard measure of the endowment effect, WTA/WTP. The results are clear: there is no sign of correlation between the two variables. This is confirmed by statistical analysis: the ORIV correlation is -0.07 (.072).[31] As in the case of WTA and WTP, this lack of a relationship is not due to noise in eliciting c—the two elicitations of FM–Mixed are correlated 0.83 with each other.

Next, we examine the precise theoretical predictions derived in Section 2.3 for specific functional forms. We do so through correlations and regressions, with the results presented in Table 5. We estimate a number of specifications, accounting for the fact that the specific predictions vary according to assumptions over the functional form of the utility, and to whether money is encoded as a loss.

Our theoretical analysis shows that we should have a perfect correlation between the negative of the inverse of the FM–Mixed measure ($-1/c$) and various measures of the endowment effect, depending on the functional form.[32] These predictions are tested in Panel A. In all three specifications, the correlations are small, of varying sign, and statistically indistinguishable from zero.

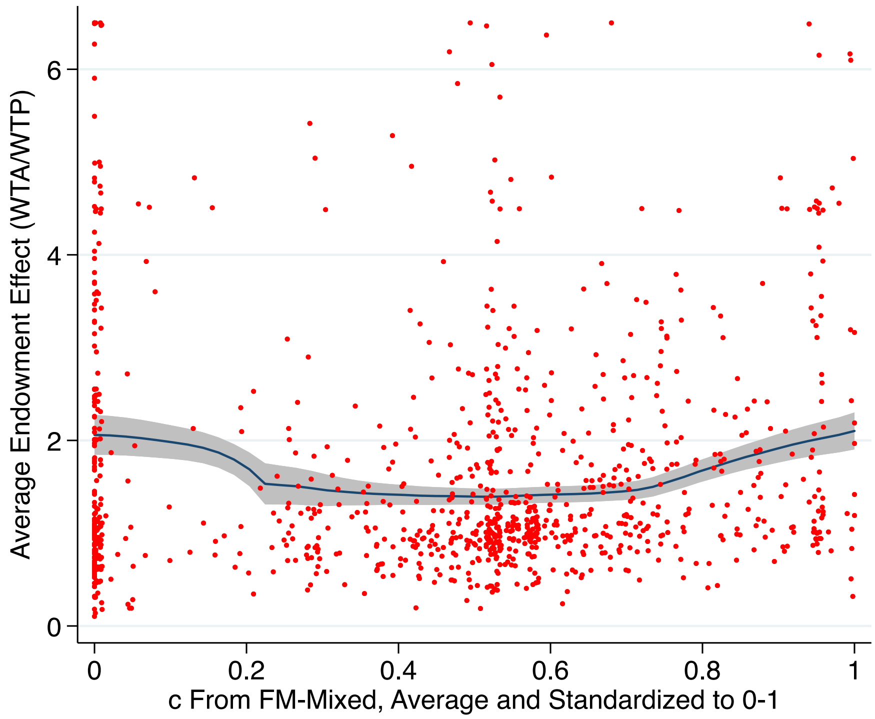
The second and third panels of Table 5 use measures of the parameters of the CRRA utility function—loss aversion (λ) and utility curvature (α)—elicited using the DOSE method (Chapman, Snowberg, Wang, and Camerer, 2019), as described in Section 3.3. In Panel B, we regress our various measures of the endowment effect on these parameters. Once again, the

[30]To our knowledge, only two papers report related tests, Gächter, Johnson, and Herrmann (2007) and Dean and Ortoleva (2019), although with significant differences in methodology. We discuss these in Appendix B.

[31]We find statistically insignificant results between c and various measures of the endowment effect—with or without controls for risk aversion—in Appendix Table C.1.

[32]This is true only in the absence of measurement error. We use ORIV estimates of the correlations–which produce consistent estimates in the presence of idiosyncratic measurement error.

Figure 2: No evidence of correlation between c and the Endowment Effect



Notes: Scatter plot is shown with a small amount of jitter. Horizontal axis standardizes c between 0 and 1 before averaging.

estimates of the relationship with loss aversion are small and statistically-indistinguishable from zero.[33] This lack of relationship is unlikely to be caused by measurement error in the DOSE estimation, which Chapman, Snowberg, Wang, and Camerer (2019) show to be small. Indeed, Table 5 shows that α is related to the endowment effect. Further, note that the DOSE parameters are correlated with other similar variables in our dataset—the correlation between α and Fixed Lottery Gain is 0.35 (.05), and between λ and FM–Mixed is 0.47 (.04)—indicating that the measures are not just noise.

Finally, in Panel C of Table 5, we use the DOSE parameters to construct the specific functions of the parameters that are theoretically predicted to be the same as measures of the endowment effect. In particular, as shown in Section 2.3, using a CRRA utility function and encoding both money used for purchasing and the lottery when sold as losses, theory predicts that $\lambda^{\frac{2}{\alpha}}$ is (perfectly) positively correlated with $\frac{\text{WTA}}{\text{WTP}}$, or that $\lambda^{\frac{1}{\alpha}}$ is (perfectly) correlated

[33]In Appendix C, we re-estimate the DOSE parameters using a utility function that exhibits CARA, and show that there is no evidence of a relationship between the λ estimated that way, and any of our measures of the endowment effect.

Table 5: Relationships between the endowment effect, and loss and risk aversion.

Dependent Variable:	Endowment Effect $\sqrt{\text{WTA/WTP}}$	WTA/WTP	WTA−WTP
Panel A: Relationship with FM–Mixed (N = 1,000; ORIV Correlations)			
$-1/c \propto \lambda^{1/\alpha}$	−0.05	−0.11	0.04
(from FM–Mixed)	(.072)	(.073)	(.070)
Panel B: DOSE using CRRA (N = 3,000; multivariate regressions)			
λ	−0.02	−0.03	0.02
	(.016)	(.026)	(.025)
α	0.04**	0.06*	0.11***
	(.018)	(.030)	(.030)
Panel C: DOSE Functional Forms (N = 3,000; correlations)			
$\lambda^{\frac{2}{\alpha}}$		0.00	
		(.031)	
$\lambda^{\frac{1}{\alpha}}$	0.00	0.00	
	(.030)	(.030)	

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level. Standard errors in parentheses. For correlations and ORIV correlations, standard errors are bootstrapped from 10,000 simulations.

with $\sqrt{\frac{\text{WTA}}{\text{WTP}}}$. If only the sale of the lottery is encoded as a loss, then theory predicts that $\lambda^{\frac{1}{\alpha}}$ is (perfectly) positively correlated with $\frac{\text{WTA}}{\text{WTP}}$. In our data, however, these correlations are small and statistically indistinguishable from zero.

In summary, to match our data with these models, we would need to dispense with a unified notion of loss aversion, and specify that the loss aversion for risk is independent of the loss aversion governing the buying and selling of lotteries. Alternatively, one could consider other models of the endowment effect. The next section surveys some potential alternatives.

5 Other Theories of the Endowment Effect

In light of the difficulty in reconciling our results with standard models of reference-dependent preferences that use a unified notion of loss aversion, we now enlarge our scope to consider some of the many alternative models of the endowment effect that have been proposed in economics and psychology. As the entire literature on this topic is much too large to be described here, we focus on the most popular models that have the potential of fitting our key findings—a lack of correlation between WTA and WTP, and a lack of correlation between the endowment effect and loss aversion for risk.

Incomplete Preferences. An alternative explanation of the endowment effect connects it to preference *incompleteness*, which assumes individuals may be unable to confidently compare some alternatives. Formally, there may be some x and y such that it is neither the case $x \succsim y$ nor $y \succsim x$. When paired with a form of inertia—individuals stay with their endowment unless they find an alternative they know they like better, according to their preferences—this incompleteness can lead to status quo bias and the endowment effect (Bewley, 1986; Masatlioglu and Ok, 2005, 2014; Ortoleva, 2010).[34] As an example, an individual may be not sure how to compare a mug to amounts between \$10 and \$15 (that is, for any x between these amounts it is neither the case that $x \succsim$ mug nor mug $\succsim x$). When selling the mug this individual is unwilling to accept less than the the lowest amount they know is better than the object (\$15), and when buying is willing to pay no more than the highest amount they know is worse (\$10), creating a disparity.[35] The correlation between WTA and WTP is thus governed by the relation between the minimum and maximum of the range of valuations for an object: to fit our data, these extremes need to be independent.[36]

In their typical formulations, these models make no prediction on loss aversion for risk. Thus, these models cannot be falsified by comparing loss aversion to moments derived from WTA and WTP.

Cautious Utility. A closely related approach to incomplete preferences is the model of *cautious utility* (Cerreia-Vioglio, Dillenberger, and Ortoleva, 2021). According to this theory, individuals have a *set* of utility functions, but aggregate them using a criterion of *caution*: the value they assign to each alternative is the lowest value (calculated as monetary certainty-

[34] A related approach relies on preference imprecision instead of incompleteness, see Dubourg, Jones-Lee, and Loomes (1994); Butler and Loomes (2007); Cubitt, Navarro-Martinez, and Starmer (2015).

[35] Formally, each individual is endowed with a (possibly) incomplete preference relation $\succcurlyeq$2598 and chooses option x against current endowment y if and only if $x \succ y$. Whenever $\succcurlyeq$ is incomplete, individuals exhibit inertia: if x and y are incomparable, they stay with their endowment x or y when offered the other as an alternative.

[36] As formalized in the literature, these models do not allow for individuals to have a negative endowment effect, which seems to be exhibited by a substantial minority of participants in our, and prior, studies, see Section 4.1 and Appendix B. These theories could be made consistent with a negative endowment by replacing status-quo bias with an action bias—when unsure individuals move away from their endowment.

equivalent) given by each utility in the set.[37] This leads to an endowment effect. Intuitively, the most pessimistic scenario when buying is to buy a "lemon"—thus agents use a low value, hence low WTP. On the other hand, when selling, the worst scenario is selling a "peach"—hence high WTA. This is true even if each utility function is itself symmetric for gains and losses. Again, this approach is compatible with a lack of correlation between WTA and WTP as long as the low and high values implied by the set of utility functions are unrelated.

Loss aversion for risk occurs in Cautious Utility when members of the set of utilities disagree on how to aggregate gains and losses. In that case, the individual prefers zero for sure to a lottery with gains and losses, generating loss aversion for risk. When the difficulty in aggregating monetary gains and losses is unrelated to the doubts on the value of an object, the Cautious Utility model allows for a zero correlation between loss aversion for risk and the endowment effect, as in our data (Cerreia-Vioglio, Dillenberger, and Ortoleva, 2021).

Reference Prices. A related approach is to allow for the possibility that individuals have a well-defined, unique value of the object v, but in determining WTA and WTP they consider also a reference price r, and have a reluctance to trade with terms that seem unfavorable compared to this reference price (Weaver and Frederick 2012; see also Thaler 1985; Isoni, Loomes, and Sugden 2011). When $r > v$, individuals are not willing to pay more than v—they don't want to purchase an object for a price above the value they assign to it. However, they are also not willing to accept less than r to sell it, as that would feel like a "bad deal." If r and v are independent, so too are WTA and WTP. This model makes no predictions involving loss aversion for risk.

Salience. A separate approach is to assume that individuals attach disproportionate weight to the features of objects that "stand out" when making choices, as in salience theory (Bordalo, Gennaioli, and Shleifer, 2012a).[38] If, when given a good for free (as in endowment effect experiments), individuals compare it to having nothing (which they did, a moment before), and therefore focus on the object's positive aspects, then they will have a higher

[37]Formally, individuals have a set of utility functions $\mathcal{W}$ on bundles in $\mathbb{R}^k$ and evaluate each option, expressed in terms of changes relative to the reference point, by $V(x) = \inf_{v \in \mathcal{W}} v_1^{-1}(v(x))$, where v_1^{-1} is a certainty equivalent in terms of sure amounts of money—that is, the lowest amount of money received for sure that gives the same utility as the bundle.

[38]Formally, in this model, the value of each object is calculated by aggregating the utility of each of its characteristics, as in the standard model. However, aggregation uses weights on each characteristic that depend on the salience.

value for the object, and thus a high WTA. This, in turn, leads to an endowment effect. This model allows a zero correlation between WTA and WTP if there is no relation between the valuation of an object when focusing on positive aspects and the person's value for the object when all characteristics are equally salient.

For this model to generate loss aversion for risk, there needs to be an asymmetry between gains and losses (Bordalo, Gennaioli, and Shleifer, 2012b). Similar to prospect theory, this asymmetry will also increase the endowment effect. The only way for loss aversion and the endowment effect to be independent is if the positive correlation induced by the asymmetry underlying both phenomena is exactly offset by a negative correlation with salience.

Biased Information Processing. Another group of theories focuses on how buying and selling frames evoke different information. It is well known that people access different information—from memory and/or the environment—when confronted with different tasks. This can generate the endowment effect if the act of selling increases the availability of information pointing towards keeping the good, while the opposite happens during the activity of buying (Carmon and Ariely, 2000; Nayakankuppam and Mishra, 2005; Johnson, Häubl, and Keinan, 2007; Ashby, Dickert, and Glöckner, 2012; Pachur and Scheibehenne, 2012).[39] Supporting these theories is the fact that these processes can be exogenously manipulated, leading to different effects: inducing buyers to consider positive features of the goods increases WTP, while the same information does not affect WTA of sellers; the reverse happens with information related to negative features of the goods (Carmon and Ariely, 2000; Nayakankuppam and Mishra, 2005; Johnson, Häubl, and Keinan, 2007). As these models assume that WTA and WTP are based on different information, they are compatible with the lack of correlation between the two. As most of these models do not address loss aversion for risk, they also do not make predictions on its relationship with the endowment effect.

Distinct Cognitive Processes. A more speculative and not-yet formalized approach is suggested by recent work in neuroscience, where there is evidence of two different mechanistic neural processes governing buying and selling. An early fMRI study found distinct activity in the medial prefrontal cortex (mPFC) when making a buying decision at a low price and

[39]For example, buyers of pens and lotteries recall fewer positive and more negative attributes than sellers (Nayakankuppam and Mishra, 2005; Saqib, Frohlich, and Bruning, 2010). Similarly, buyers of basketball tickets tend to consider costs of attending the game, while sellers consider the benefits of attending (Carmon and Ariely, 2000).

(more weakly) a selling decision at a high price (Knutson, Wimmer, Rick, Hollon, Prelec, and Loewenstein, 2008). This region encodes abstract integrated types of value, which is consistent with a value for being relatively confident in getting a good deal. Further, the size of the endowment effect was correlated with the amount of differential activity in the insula during selling versus buying. This may indicate that selling and buying decisions are processed differently in the brain, and the difference is likely associated with more uncertainty or emotional discomfort during selling (as those are common functions of the insula). Another study found increased activity in the amygdala and caudate nucleus during selling; the former is consistent with enhanced emotional salience during selling (Weber, Aholt, Neuhaus, Trautner, Elger, and Teichert, 2007). Finally, there is evidence that WTP is processed by the medial orbitofrontal cortex (mOFC), while WTA is processed by a more lateral portion of the OFC (the lOFC, see De Martino, Kumaran, Holt, and Dolan, 2009). These studies do not form a simple, integrated neuro-psychological picture, but all show differences in neural processing during buying versus selling.

Evidence consistent with these different cognitive processes can be found in response times to our own questions. In our experiments, the WTA module had much shorter response times than the WTP module. The median response time for WTA questions was 88 seconds, while it was 122 seconds for WTP.[40] This difference is large: of the eight risk aversion modules in Section 4.4, WTP has the longest median response time, while the Risk Aversion Gain module had the shortest (74 seconds). Moreover, although participants take longer on earlier modules, even when the WTP module is randomly selected to be later in the survey, it still takes longer than WTA when WTA is randomly selected to be earlier in the survey. This difference is compatible with the idea that different processes are involved in buying and selling.

Summary. A first group of theories allows for independent WTA and WTP, but does not model loss aversion for risk: these include incomplete preferences, reference prices, and biased information processing. It is likely that adding a mechanism for loss aversion for risk to these models would provide a second channel for an endowment effect, leading to a positive correlation between the two. This is true in the Salience model, which has been

[40]This difference was true question-by-question as well. Moreover, this difference is unlikely to be driven by the slightly longer instructions of the WTP questions, which, based on similar length instructions elsewhere, likely only added 5 seconds to the WTP question.

adapted to capture both phenomena.

Other models allow for independent WTA and WTP as well, but can also capture loss aversion for risk as a separate phenomenon from the endowment effect—for example, Cautious Utility. More broadly, suggestive evidence in neuroscience points to the possibility that different cognitive processes can be involved in the acts of buying, selling, and in loss aversion for risk; these mechanisams are, however, not yet formalized.

6 Conclusions

Using multiple large, representative, incentivized surveys, we document a number of facts about WTA, WTP, and the endowment effect. We find that WTA and WTP are largely uncorrelated. This holds even though we replicate the standard finding that a majority of people exhibit the endowment effect, and even though our measures of WTA, WTP, and the endowment effect are not just noise—for example, they are as stable across time as other measures, including those of risk and time preferences. We also document that WTA and WTP are correlated with other measures of risk preferences in a sensible way, depending on whether the fixed option in an MPL is a monetary amount or a lottery, suggesting that whether a question is framed as "buying" or "selling" is important.

A zero or small correlation between WTA and WTP is compatible with standard theories of reference-dependent preferences only under very specific parameters—essentially, if the variance in reference-free valuations of lotteries is perfectly equal to the variance due to reference dependence. This has at least two immediate implications. First, it rules out the popular special case in which all small-stake risk aversion comes from loss aversion. Second, it implies that "behavioral" factors are at least as important as standard economic factors in explaining variation across individuals in WTA and WTP.

Models of reference-dependent preferences that adopt a unified notion of loss aversion make an additional prediction: the endowment effect should be correlated with loss aversion for risk. This relation is at the core of explanations of the endowment effect that rely on loss aversion. Our different datasets allow us to test this prediction in multiple ways: we consistently find that it is *not* supported in our data, where the endowment effect and loss aversion for risky choice are largely unrelated.

To reconcile with our data current theories of the endowment effect based on loss aversion, two restrictions are needed. First, there needs to be a specific parametric restriction: that the variance in reference-free valuations is the same as the variance induced by the effects of reference-dependent preferences, such that they offset each other to give a zero correlation between WTA and WTP. As discussed above, this rules out popular special cases. Second, the loss aversion that affects values for risky lotteries with positive and negative payoffs is unrelated with the parameter of loss aversion that leads to the endowment effect for lotteries. That is, we need to abandon a unified notion of loss aversion.

Alternatively, we could consider the many other models of the endowment effect that have been developed in economics, psychology, and neuroscience. While selecting between these options is beyond the scope of this work, many are compatible with all our data, and some offer additional predictions.

We conclude by noting that our data only elicited WTA and WTP for lotteries. We believe lotteries to be a natural object of study due to their central importance in economics. However, whether similar patterns hold for other types of tradable goods is an open and important question.

Appendix

A Subgroups

There may be substantial heterogeneity in the correlation between WTA and WTP for specific subgroups, or based on response properties. We examine the correlation between WTA and WTP for a number of subgroups, in Table A.1. Correlations are examined by lottery, for the average of both lotteries, and using ORIV. To maximize statistical power, we combine Study 1, Wave 1 with Studies 2 and 3. This gives us a total of 4,000 independent observations.[41]

Most of the subgroups in the table need no explanation. However, a few do. "Not too fast" removes those participants whose time to complete all the WTA and WTP questions was in the fastest 10% of times. Similar to our approach in Figure 1, we show three additional ways of removing "extreme" choices in the table: one removes dominated options, one removes participants whose switching point was just before the first selectable item or just after the last; the third removes participants if their switching point was in the top three or bottom three rows. In all studies, we administered the Cognitive Reflection Test of Frederick (2005). We also administered an in-study IQ test. This test took a fixed set of six questions from the International Cognitive Ability Resource (ICAR; Condon and Revelle 2014). These six questions were chosen from the matrix and three-dimensional rotation modules such that they were progressively more difficult.

In almost all subgroups, correlations between WTA and WTP are small in magnitude and/or negative. The only robust positive correlation is for those who answered all six of the IQ questions correctly. Here, the correlation goes as high as 0.30, although including the next 5% of participants in terms of IQ reduces the correlation to around 0.08.

B Prior Studies

In order to examine the correlation between WTA and WTP, one needs a within-participant design. A few studies have collected such data, and by collecting and examining this data

[41] Wave 2 consists of the same participants as Wave 1, hence the observations are not independent. For results by survey, see (Chapman, Ortoleva, Snowberg, Dean, and Camerer, 2017).

Table A.1: Correlations for Subgroups. Data from Study 1, Wave 1 and Studies 2 and 3

	N	Lottery 1	Lottery 2	Average	ORIV
All	4,000	-0.08^{***}	-0.08^{***}	-0.09^{***}	-0.11^{***}
		(.027)	(.027)	(.027)	(.033)
Not Too Fast	3,572	-0.08^{***}	-0.08^{***}	-0.09^{***}	-0.11^{***}
		(.028)	(.027)	(.027)	(.033)
No Dominated Choices	3,354	-0.08^{***}	-0.08^{***}	-0.10^{***}	-0.11^{***}
		(.029)	(.027)	(.028)	(.034)
No Switches in Top or Bottom Two Rows	2,600	-0.12^{***}	-0.13^{***}	-0.12^{***}	-0.17^{***}
		(.038)	(.035)	(.037)	(.044)
No Switches in Top or Bottom Three Rows	1,509	−0.01	−0.00	−0.00	−0.02
		(.051)	(.043)	(.050)	(.071)
Question Order: WTA First	1,995	-0.10^{***}	-0.09^{**}	-0.10^{***}	-0.12^{***}
		(.039)	(.039)	(.038)	(.047)
Question Order: WTP First	2,005	-0.07^{*}	-0.07^{*}	-0.08^{**}	-0.10^{**}
		(.038)	(.038)	(.038)	(.045)
Education: HS or Less	1,611	-0.14^{***}	-0.09^{*}	-0.13^{***}	-0.16^{***}
		(.046)	(.048)	(.047)	(.059)
Education: Some College	1,996	−0.04	-0.08^{***}	-0.06^{*}	-0.08^{**}
		(.034)	(.033)	(.034)	(.040)
Education: Advanced Degree	393	−0.01	−0.02	−0.01	−0.02
		(.064)	(.056)	(.061)	(.075)
Income: Above Median	1,881	−0.03	−0.05	−0.03	−0.04
		(.032)	(.035)	(.034)	(.040)
Income: Top Quartile	1,019	0.01	0.00	0.02	0.02
		(.048)	(.050)	(.048)	(.059)
Income: Top Decile	483	0.08	0.02	0.05	0.06
		(.065)	(.067)	(.067)	(.080)
CRT: Above Median (1+ Questions Correct)	1,752	0.04	−0.00	0.03	0.03
		(.038)	(.035)	(.037)	(.045)
CRT: Top Decile (All Questions Correct)	338	0.10	0.01	0.06	0.07
		(.067)	(.074)	(.072)	(.088)
IQ: Above Median (3+ Questions Correct)	2,265	-0.07^{*}	-0.07^{***}	-0.08^{***}	-0.10^{***}
		(.036)	(.031)	(.033)	(.040)
IQ: Top Decile (5+ Questions Correct)	424	0.08	0.10	0.09	0.10
		(.076)	(.064)	(.074)	(.086)
IQ: Top 5% (All Questions Correct)	156	0.30^{***}	0.23^{***}	0.26^{***}	0.32^{***}
		(.081)	(.083)	(.085)	(.11)
Age: Youngest Quartile	1,007	-0.23^{***}	-0.26^{***}	-0.29^{***}	-0.36^{***}
		(.063)	(.059)	(.061)	(.074)
Age: Second Youngest Quartile	1,007	−0.03	−0.04	−0.04	−0.04
		(.050)	(.049)	(.048)	(.058)
Age: Second Oldest Quartile	1,070	−0.01	0.05	0.01	0.01
		(.047)	(.050)	(.048)	(.060)
Age: Oldest Quartile	915	-0.08^{*}	-0.12^{***}	-0.09^{*}	-0.13^{**}
		(.045)	(.048)	(.047)	(.055)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, with bootstrapped standard errors from 10,000 simulations in parentheses.

we can see the extent to which our results are consistent with those of prior studies.

We are aware of two studies that report a correlation between WTA and WTP. Borges and Knetsch (1998) elicited valuations for the purchasing and selling "Scratch and Win" tickets issued by the British Columbia Lottery Corporation, and reports a correlation of 0.24 (Kendall rank-order 0.15, Spearman rank-order 0.19, $N = 45$). They also report a correlation of 0.35 between the WTA and WTP for a lottery (Kendall rank-order 0.33, Spearman rank-order 0.26, $N = 28$), using data from Kachelmeier and Shehata (1992). Brown, Kapteyn, Luttmer, and Mitchell (2017) elicits valuations for two hypothetical annuities, and finds negative correlations between WTA and WTP of -0.11 and -0.15.

We perform a meta-analysis of five laboratory studies ($N = 790$), finding an average correlation—weighted by the number of participants in each study—of 0.13. This correlation is about the same size as in our representative surveys, but with the opposite sign. The meta-analysis includes all studies—reported in Table B.1—that use within-person incentivized measures of WTA and WTP for lotteries and which have data available.[42] The percentage of participants expressing a negative endowment effect—around 25%—is also quite similar to what we observe in our data (see Table 2).

Although the average correlation across all studies is similar in magnitude to our studies, the correlations vary considerably across studies and lotteries, as shown in Table B.1.[43] This is perhaps unsurprising given that these prior studies are much smaller, and use a range of participant pools and methodologies. The first four studies in the table use the BDM method (Becker, DeGroot, and Marschak, 1964) to elicit WTA and WTP for several lotteries. The fifth study used a median-price auction, repeated six times for two lotteries, with

[42] We searched all papers published in top economics journals. We also consulted the comprehensive annotated bibliography by Peter Wakker (http://people.few.eur.nl/wakker/refs/webrfrncs.docx). This yielded ten studies. Tunçel and Hammitt (2014) conducts a similar search and finds five studies with within-subject designs—all of which were also found by our search. Two no longer had data available (Harless, 1989; Eisenberger and Weber, 1995).

We excluded three other datasets from the meta-analysis: Schmidt and Traub (2009) and Schmidt and Trautmann (2014) use the same data, which contains 23 participants making choices over 50 lotteries. The range of correlations of WTA and WTP in those lotteries is from -0.67 to 0.86, with an average of 0.19. Most of these correlations are statistically insignificant due to the very small sample size. Dean and Ortoleva (2019) measure WTA and WTP for the same participants, but the WTP measure is explicitly framed, while the WTA measure is implicitly framed, making it incomparable to other results. The reported correlation between the two measures is 0.33. Plott and Zeiler (2005) measures WTA and WTP for lotteries in training rounds, although the lotteries were not exactly the same, as the lotteries used to measure WTA and WTP differed by a constant, but does not report this data due to concerns about reliability.

[43] Dropping dominated choices, or replacing them with undominated options, results in similar overall patterns, although the value of particular correlations changes, sometimes substantially.

Table B.1: The correlation between WTA and WTP for lotteries over gains is limited in prior studies.

Study	Group (N)	Lottery	Correlation	WTA < WTP
Isoni et al. (2011)	1 (100)	$0.3 * 1 \oplus 0.7 * 4$	0.01 (.10)	16%
		$0.5 * 1.5 \oplus 0.5 * 3.5$	0.03 (.10)	37%
		$0.6 * 1 \oplus 0.4 * 3$	0.20** (.10)	21%
		$0.7 * 0.1 \oplus 0.3 * 0.8$	0.03 (.10)	26%
		$0.7 * 1 \oplus 0.3 * 5$	0.10 (.10)	31%
		Average	0.15 (.10)	26%
Fehr et al. (2015)	1 (95)	$0.3 * 1 \oplus 0.7 * 8$	0.15 (.10)	25%
		$0.5 * 1 \oplus 0.5 * 1.5$	0.26** (.10)	35%
		$0.5 * -3 \oplus 0.5 * 9$	0.34*** (.10)	19%
		$0.6 * 1 \oplus 0.4 * 6$	0.20* (.10)	24%
		$0.7 * -0.1 \oplus 0.3 * 0.8$	0.21** (.10)	33%
		$0.7 * 1 \oplus 0.3 * 11$	0.11 (.10)	32%
		Average	0.29*** (.10)	28%
	2 (96)	$0.5 * 1 \oplus 0.5 * 1.5$	0.15 (.10)	28%
Kachelmeier-Shehata (1992)	1 (28)	$0.5 * 0 \oplus 0.5 * 20$	0.35* (.18)	7%
Vosgerau-Peer (2018)	1 (95)	$0.5 * -5.20 \oplus 0.5 * 7.8$	−0.20* (.10)	n.a.
	2 (201)	$0.5 * -3 \oplus 0.5 * 4.5$	0.11 (.0.07)	n.a.
Loomes et al. (2003)	1 (175)	$0.2 * 0 \oplus 0.8 * 12$	0.31*** (.072)	35%
		$0.8 * 0 \oplus 0.2 * 12$	0.24*** (.074)	35%
		Average	0.20*** (.075)	35%

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level. Correlations with standard errors in parentheses. Lotteries are denoted by probabilities of each prize times the size of the prize, separated by ⊕. Average correlations are estimated using individual-level averages of WTA and WTP across all lotteries.

the price posted after each round. This lead to the largest and most statistically significant correlations in the table, likely because averaging across six rounds reduced measurement error substantially. However, it is also worth noting that the correlation in each round was substantially lower than the average, and was relatively stable across rounds.[44] The proportion with a negative endowment effect was also very stable across rounds. This indicates that these features are unlikely to be due to "mistakes."

We are aware of two studies that report the correlation between the endowment effect and loss aversion for risk. Gächter, Johnson, and Herrmann (2007) find a significant positive correlation between the two. Unlike our study, the endowment effect was measured for an object (a toy car) rather than a lottery. Dean and Ortoleva (2019) find a positive correlation between loss aversion for risk and the endowment effect for lotteries. There are a number of differences between this study and the one reported in this paper, including the use of a highly-selected student sample and a different elicitation procedure for WTA, which is not explicitly framed as a sale. Identifying the cause of the different result is an important avenue for future research.

C Other Formulations of Reference-Dependent Preferences

C.1 Constant Absolute Risk Aversion and Generic Utility

Similar results to those obtained in Section 2 also apply, up to an approximation, to the case of a utility function with constant absolute risk aversion (CARA) and, more in general, for any strictly increasing utility function.

[44] Specifically, after each of the six rounds, the price was posted. The correlation averaged across six rounds is on the high end compared to BDM-based studies, but this is in large part due to a reduction in measurement error: the correlations for individual rounds tend to be around 0.2.

CARA. Assume $u(x) = 1 - e^{-\rho x}$ for $x > 0$, while, as before, $u(x) = -\lambda u(-x)$ for $x < 0$. Then:

$$-\lambda(1 - e^{-\rho \mathrm{WTP}}) + V = 0 \qquad \mathrm{WTP} = -\frac{\log(1 - V/\lambda)}{\rho}$$

$$1 - e^{-\rho \mathrm{WTA}} - \lambda V = 0 \qquad \mathrm{WTA} = -\frac{\log(1 - \lambda V)}{\rho}$$

Using a first-order Taylor expansion of $\log(1-x) \approx -x$, and defining $\hat{\hat{V}} = V/\rho$, we have that

$$\mathrm{WTP} \approx \hat{\hat{V}}/\lambda \qquad \mathrm{WTA} \approx \lambda\hat{\hat{V}}.$$

The difference between this functional form and CRRA is second order, and thus similar conclusions regarding the correlation between WTA and WTP hold. In particular, a zero correlation between WTA and WTP can occur if the variance in the value of the lottery is offset by variance of the loss aversion term, ruling out the case of linear utility, and loss aversion being relatively unimportant.

Now consider loss aversion for risk measured by c, as described in the text, where $c < 0$ is such that $\frac{1}{2}y + \frac{1}{2}c \sim 0$. Thus,

$$\frac{1}{2}(1 - e^{-\rho y}) - \frac{1}{2}\lambda(1 - e^{\rho c}) = 0 \quad \Leftrightarrow \quad \rho c = \log\left(1 - \frac{1 - e^{-\rho y}}{\lambda}\right).$$

Using the same first-order Taylor expansion yields

$$\rho c \approx -\frac{1 - e^{-\rho y}}{\lambda} \quad \Leftrightarrow \quad \lambda \approx -\frac{1}{c}\left[\frac{1 - e^{-\rho y}}{\rho}\right].$$

As in our baseline specification, we have that loss aversion is related to $-1/c$, while the endowment effect as measured by WTA/WTP is equal to λ^2, meaning we should find a positive correlation between $-1/c$ and $\sqrt{WTA/WTP}$.

Generic Utility. Consider now the more general case of a strictly increasing utility function u such that $u(0) = 0$ and $u(x) = -\lambda u(-x)$ for $x < 0$. Then

$$u(\text{WTP}) = V/\lambda \qquad \text{WTP} = u^{-1}(V/\lambda)$$
$$u(\text{WTA}) = \lambda V \qquad \text{WTA} = u^{-1}(\lambda V).$$

When the effect of u^{-1} on WTA and WTP is second-order, which is likely the case for moderate values of loss aversion or when the utility has mild curvature, then we obtain very similar expressions to those above. Specifically, taking Taylor series expansions around $u^{-1}(0)$ gives WTP $\approx \frac{1}{\lambda}\frac{V}{u'(0)}$ and WTA $\approx \lambda\frac{V}{u'(0)}$. This is structurally similar to our previous results: for WTA (WTP), it is a term that depends on the utility function multiplied by (the inverse of) λ.

The relationship between the endowment effect and loss aversion for risk is also similar, as, starting from $\frac{1}{2}y + \frac{1}{2}c \sim 0$, we have

$$c = -u^{-1}\left(\frac{u(y)}{\lambda}\right).$$

Using a Taylor series expansion around $y = 0$ gives $c \approx -\frac{y}{\lambda}$, similar to before.

C.2 The Kőszegi-Rabin Model

We now consider the implications of the Kőszegi and Rabin (2006; KR) model for both the correlation between WTA and WTP, and the relationship between the endowment effect and alternative measures of loss aversion.

The KR model assigns a utility to a lottery p when compared to a reference lottery q with payoffs across a (finite) prize space X:

$$U(p|r) = \sum_{y\in X}\sum_{r\in X} u(x|r)p(x)q(r),$$

in which $u : X \times X \to \mathbb{R}$ is the deterministic reference utility—that is, $u(x|r)$ is the utility of prize x from the point of view of reference point r. We follow others, including examples in KR in assuming that

$$u(x|r) = \begin{cases} u(x) + (u(x) - u(r)) & \text{if } u(x) \geq u(r) \\ u(x) + \lambda(u(x) - u(r)) & \text{if } u(x) < u(r). \end{cases}$$

In keeping with our earlier treatment, we assume the lottery is the reference point when calculating WTA. Recall that the lottery gives a 0.5 chance of winning a prize h and a 0.5 prize of winning a prize l. Thus

$$\sum_{x \in \{h,l\}} \frac{1}{2} u(WTA|x) = \sum_{x \in \{h,l\}} \sum_{x \in \{h,l\}} \frac{1}{4} u(x|r),$$

in which the left hand side is the utility of selling the lottery for an amount WTA, while the right hand side is the utility of keeping the lottery. This implies

$$u(WTA) + \frac{1}{2}\left(u(WTA) - u(l)\right) + \frac{1}{2}\lambda\left(u(WTA) - u(h)\right) = V + \frac{1-\lambda}{4}\left(u(h) - u(l)\right),$$

in which $V = \frac{1}{2}u(h) + \frac{1}{2}u(l)$, as before. The solution to this equation is given by

$$u(WTA) = V.$$

To calculate WTP we assume that an individual's endowment e is the reference point. This gives

$$\begin{aligned} u(e) &= \sum_{x \in \{h,l\}} \frac{1}{2} u(e + x - WTP)|e) \\ &= \frac{1}{2}(1+\lambda)\left[u(e + l - WTP) - u(e)\right] + u(e + h - WTP). \end{aligned}$$

Rearranging gives

$$\begin{aligned} \frac{1}{2}(3+\lambda)u(e) &= u(e + h - WTP) + \frac{1}{2}(1+\lambda)u(e + l - WTP) \\ \frac{dWTP}{d\lambda} &= \frac{\frac{1}{2}(u(e + l - WTP) - u(e))}{u'(e + h - WTP) + u'(e + l - WTP)}. \end{aligned}$$

Note that the last term is negative, as $WTA > l$. Thus, according to the KR model, WTA depends only on the expected utility of the lottery, while WTP depends on both loss aversion (negatively) and the expected utility of the lottery.

There are two ways to generate a zero correlation between WTA and WTP. The first is for there to be no variation in V (this includes the popular special case in which utility is locally linear). However, as discussed in the text, our data is incompatible with this case, as it would imply that variation in WTA is purely noise, and yet we find it to be correlated with many other variables.

The second possibility is that the covariance between V and loss aversion precisely compensates for variation in V leading to a zero correlation overall. This is similar to the version of our baseline model in which monetary outlays are not encoded as a loss.

As with our baseline specification, the KR model predicts a relationship between the endowment effect and alternative measures of loss aversion. An increase in loss aversion leaves WTA unaffected, but reduces WTP, increasing the endowment effect, as defined either as either $WTA - WTP$ or WTA/WTP. The KR model therefore also predicts that that the endowment effect should be positively correlated with DOSE elicited loss aversion.

Turning to the lottery equivalent task for eliciting loss aversion we have

$$0 = \frac{1}{2}u(y) + \frac{1}{2}u(c) + \frac{1}{2}u(y) \cdot \frac{1}{2}\lambda u(c) \quad \Rightarrow \quad u(c) = -\frac{u(y)}{1 + \frac{1}{2}(\lambda - 1)}$$

Thus, an increase in λ will increase c, and thus also $-1/c$. The model therefore predicts a positive correlation between the endowment effect and loss aversion for risk.

C.3 Additional Empirical Tests

As shown above, a utility function that exhibits CARA produces substantially similar theoretical results. We can then examine the role of CARA in our empirical results by re-estimating DOSE using a functional form for u that exhibits CARA, and use these parameters in much the same way as in Table 5. The results are in Panel A of Table C.1. Once again, the correlations between various measures of the endowment effect and λ are small, and statistically indistinguishable from zero.

Panel B and C of Table C.1 enter FM–Mixed directly into these tests (as c, rather than as $-1/c$), as in Figure 2. The statistical analysis confirms the visual pattern of a lack of correlation between that measure and various measures of the endowment effect.

Table C.1: Relationships between the endowment effect, and loss and risk aversion—additional specifications.

Dependent Variable:	Endowment Effect $\sqrt{\text{WTA/WTP}}$	WTA/WTP	WTA−WTP
Panel A: DOSE CARA Parameters (N = 3,000; Multivariate regression)			
λ	−0.01	−0.03	0.03
	(.016)	(.026)	(.025)
ρ	−0.03	−0.04	−0.10***
	(.017)	(.028)	(.029)
Panel B: Relationship with FM–Mixed (N = 1,000; ORIV Correlations)			
FM–Mixed (c)	−0.01	−0.07	0.07
	(.070)	(.072)	(.068)
Panel C: Controlling for Risk Averison (N = 1,000; Multivariate regression using ORIV)			
FM–Mixed (c)	0.01	−0.06	0.09
	(.067)	(.070)	(.066)
Gain	−0.38***	−0.32***	−0.43***
(Risk Aversion)	(0.097)	(0.099)	(0.10)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level. Standard errors in parentheses. For correlations and ORIV correlations, standard errors are bootstrapped from 10,000 simulations.

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Online Appendix—Not Intended for Publication

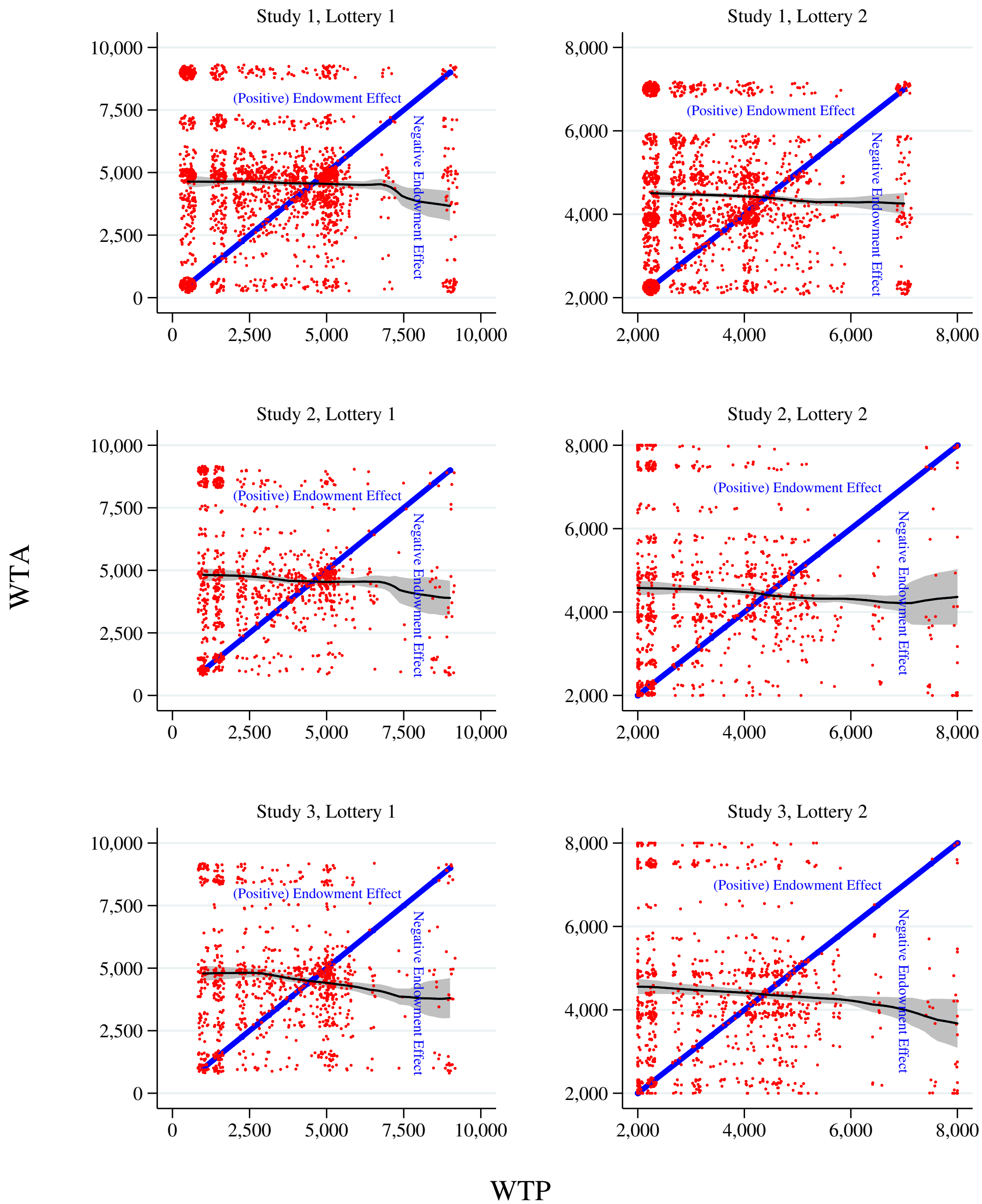
A Additional Analyses

Table A.1: Correlations of Logs of WTA and WTP

	Correlation between log(WTA) and log(WTP)				Correlation within Type	
	Lottery 1	Lottery 2	Averages	ORIV	log(WTA)	log(WTP)
Study 1, Wave 1 (N =2,000)	0.10*** (.041)	−0.02 (.037)	0.03 (.041)	0.04 (.050)	0.68*** (.024)	0.70*** (.026)
Study 1, Wave 2 (N =1,465)	0.12*** (.051)	0.00 (.047)	0.07 (.054)	0.09 (.065)	0.66*** (.034)	0.73*** (.018)
Study 2 (N =1,000)	0.04 (.051)	0.00 (.053)	0.02 (.056)	0.03 (.068)	0.65*** (.038)	0.75*** (.033)
Study 3 (N =1,000)	−0.04 (.060)	−0.06 (.056)	−0.04 (.057)	−0.05 (.068)	0.73*** (.031)	0.69*** (.047)
All Data (N =4,000)	0.08*** (.030)	−0.03 (.028)	0.02 (.029)	0.02 (.036)	0.67*** (.017)	0.68*** (.019)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, with bootstrapped standard errors from 10,000 simulations in parentheses.

Figure A.1: Summary of WTA and WTP data by Lottery and Study.



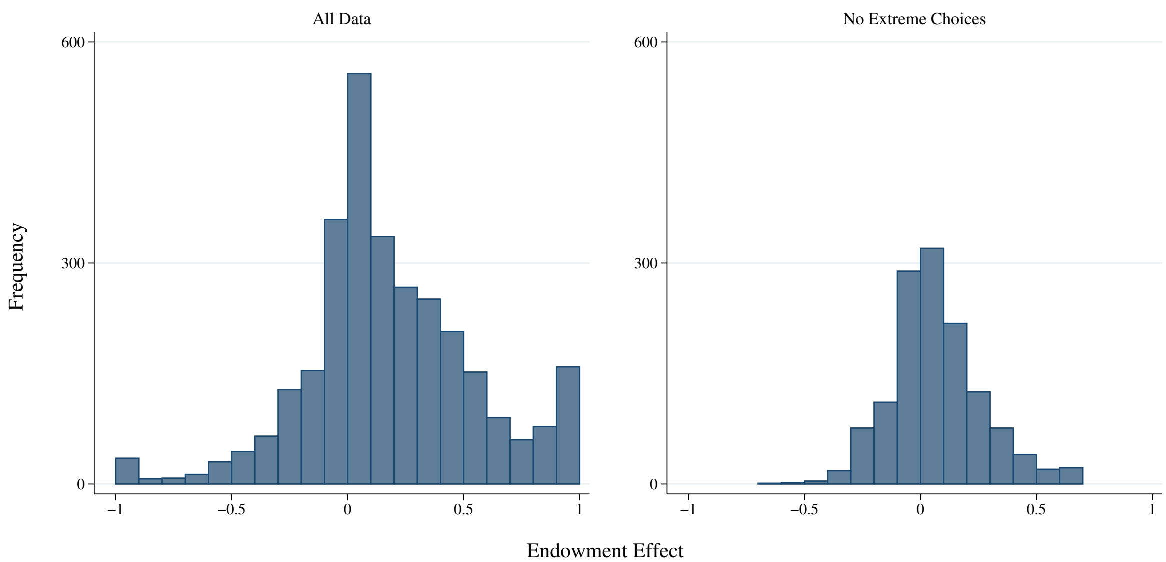
Notes: Scatter plot of choices of all participants in a given study, by lottery, with a small amount of jitter added. Lotteries and studies are described in Table 1, note that Lottery 2 in Study 1 was different from Study 2 and 3, and contained a different range of choices as it did not have (strictly) dominated options.

Table A.2: Unweighted Pearson and Spearman Correlations for Subgroups.

	N	Pearson Lottery 1	Pearson Lottery 2	Spearman Lottery 1	Spearman Lottery 2	ORIV
All	4,000	−0.05***	−0.05***	−0.03*	−0.00	−0.07***
		(.019)	(.018)	$p = 0.09$	$p = 0.96$	(.022)
Not Too Fast	3,600	−0.03*	−0.03*	−0.01	0.01	−0.05**
		(.019)	(.019)	$p = 0.55$	$p = 0.55$	(.023)
No Dominated Choices	3,390	−0.06***	−0.06***	−0.04**	−0.02	−0.08***
		(.021)	(.019)	$p = 0.03$	$p = 0.20$	(.024)
No Switches in Top or	2,595	−0.04*	−0.07***	−0.01	−0.01	−0.08***
Bottom Two Rows		(.025)	(.024)	$p = 0.54$	$p = 0.64$	(.030)
No Switches in Top or	1,469	0.01	0.03	0.02	0.04*	0.01
Bottom Three Rows		(.030)	(.030)	$p = 0.54$	$p = 0.09$	(.044)
Question Order: WTA First	2,011	−0.07***	−0.06***	−0.03	0.00	−0.09***
		(.026)	(.025)	$p = 0.15$	$p = 0.89$	(.031)
Question Order: WTP First	1,989	−0.03	−0.04*	−0.02	−0.00	−0.06*
		(.026)	(.026)	$p = 0.36$	$p = 0.84$	(.032)
Education: HS or Less	1,371	−0.10***	−0.06**	−0.07***	−0.02	−0.12***
		(.030)	(.030)	$p = 0.01$	$p = 0.49$	(.037)
Education: Some College	2,127	−0.02	−0.05*	−0.00	−0.00	−0.05
		(.025)	(.025)	$p = 0.89$	$p = 0.97$	(.031)
Education: Advanced Degree	502	−0.00	−0.01	0.04	0.08*	−0.02
		(.054)	(.050)	$p = 0.40$	$p = 0.07$	(.063)
Income: Above Median	2,091	0.01	−0.01	0.03	0.04*	0.00
		(.026)	(.025)	$p = 0.21$	$p = 0.10$	(.031)
Income: Top Quartile	1,155	0.06*	0.03	0.09***	0.08***	0.07
		(.036)	(.034)	$p = 0.01$	$p = 0.01$	(.044)
Income: Top Decile	572	0.09*	0.03	0.10**	0.08*	0.08
		(.052)	(.051)	$p = 0.02$	$p = 0.06$	(.063)
CRT: Above Median	1,916	0.05**	0.03	0.07***	0.08***	0.05*
(1+ Questions Correct)		(.027)	(.026)	$p = 0.01$	$p = 0.01$	(.033)
CRT: Top Decile	414	0.11*	0.08	0.10**	0.13***	0.11
(All Questions Correct)		(.063)	(.061)	$p = 0.04$	$p = 0.01$	(.077)
IQ: Above Median	2,316	−0.01	−0.02	0.00	0.03	−0.03
(3+ Questions Correct)		(.024)	(.023)	$p = 0.94$	$p = 0.19$	(.029)
IQ: Top Decile	473	0.10*	0.14***	0.09**	0.17***	0.14**
(5+ Questions Correct)		(.053)	(.051)	$p = 0.04$	$p = 0.01$	(.063)
IQ: Top 5%	211	0.24***	0.21***	0.18***	0.24***	0.28***
(All Questions Correct)		(.073)	(.072)	$p = 0.01$	$p = 0.01$	(.087)
Age: Youngest Quartile	697	−0.07	−0.09**	−0.04	−0.05	−0.12**
		(.045)	(.043)	$p = 0.27$	$p = 0.21$	(.056)
Age: Second Youngest Quartile	1,064	−0.06*	−0.04	−0.03	0.01	−0.07*
		(.036)	(.037)	$p = 0.34$	$p = 0.83$	(.042)
Age: Second Oldest Quartile	1,190	−0.03	0.00	−0.02	0.06**	−0.03
		(.034)	(.032)	$p = 0.52$	$p = 0.04$	(.040)
Age: Oldest Quartile	1,049	−0.05	−0.10***	−0.03	−0.05	−0.10***
		(.035)	(.034)	$p = 0.41$	$p = 0.10$	(.042)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, with bootstrapped standard errors from 10,000 simulations in parentheses. Spearman correlations are presented with $p-$values.

Figure A.2: Histogram of the Endowment Effect for WTA and WTP data in Figure 1



B Screenshots and Experimental Design Details

B.1 Screenshots

Descriptions of the WTA and WTP questions, as drawn from our design documents, are shown in the text. Here, we display screenshots of the WTA and WTP questions from Study 2. Complete design documents were uploaded with this submission, or are available at eriksnowberg.com/wep.html. We also explore the consequences of the different ordering of the MPLs, including varying the order experimentally.

Figure B.1: WTA, Lottery 1

YouGov

For this question, you are given a lottery ticket that has a **50% chance** of paying you **9,000 points,** and a **50% chance** of paying you **1,000 points**.

You have two options for this lottery ticket:

1. Keep it or
2. Sell it for a certain amount of points (for example, 3,000 points)

For each row in the table below, which option would you prefer?

☑	The lottery ticket	or	☐ Sell it for 0 points
☐	The lottery ticket	or	☐ Sell it for 1,000 points
☐	The lottery ticket	or	☐ Sell it for 2,000 points
☐	The lottery ticket	or	☐ Sell it for 2,500 points
☐	The lottery ticket	or	☐ Sell it for 3,000 points
☐	The lottery ticket	or	☐ Sell it for 3,250 points
☐	The lottery ticket	or	☐ Sell it for 3,500 points
☐	The lottery ticket	or	☐ Sell it for 3,750 points
☐	The lottery ticket	or	☐ Sell it for 4,000 points
☐	The lottery ticket	or	☐ Sell it for 4,250 points
☐	The lottery ticket	or	☐ Sell it for 4,500 points
☐	The lottery ticket	or	☐ Sell it for 4,750 points
☐	The lottery ticket	or	☐ Sell it for 5,000 points
☐	The lottery ticket	or	☐ Sell it for 5,250 points
☐	The lottery ticket	or	☐ Sell it for 5,500 points
☐	The lottery ticket	or	☐ Sell it for 6,000 points
☐	The lottery ticket	or	☐ Sell it for 7,000 points
☐	The lottery ticket	or	☐ Sell it for 8,000 points
☐	The lottery ticket	or	☐ Sell it for 9,000 points
☐	The lottery ticket	or	☑ Sell it for 10,000 points

Reset

Autofill

Review the instructions

Figure B.2: WTA, Lottery 2

YouGov

For this question, you are given a lottery ticket that has a **50% chance** of paying you **8,000 points**, and a **50% chance** of paying you **2,000 points**.

You have two options for this lottery:

1. Keep it
2. Sell it for a certain amount of points (for example, 3,000 points)

For each row in the table below, which option would you prefer?

☑	The lottery ticket	or	☐	Sell it for 1,500 points
☐	The lottery ticket	or	☐	Sell it for 2,000 points
☐	The lottery ticket	or	☐	Sell it for 2,500 points
☐	The lottery ticket	or	☐	Sell it for 3,000 points
☐	The lottery ticket	or	☐	Sell it for 3,250 points
☐	The lottery ticket	or	☐	Sell it for 3,500 points
☐	The lottery ticket	or	☐	Sell it for 3,750 points
☐	The lottery ticket	or	☐	Sell it for 4,000 points
☐	The lottery ticket	or	☐	Sell it for 4,250 points
☑	The lottery ticket	or	☐	Sell it for 4,500 points
☐	The lottery ticket	or	☑	Sell it for 4,750 points
☐	The lottery ticket	or	☐	Sell it for 5,000 points
☐	The lottery ticket	or	☐	Sell it for 5,250 points
☐	The lottery ticket	or	☐	Sell it for 5,500 points
☐	The lottery ticket	or	☐	Sell it for 6,000 points
☐	The lottery ticket	or	☐	Sell it for 7,000 points
☐	The lottery ticket	or	☐	Sell it for 8,000 points
☐	The lottery ticket	or	☑	Sell it for 9,000 points

Reset Autofill

Review the instructions

Figure B.3: WTP, Lottery 1

YouGov

For this question, you **have been given 10,000 points**. You will be offered the opportunity to exchange some of these points for a lottery ticket. This lottery ticket has a **50% chance** of paying you **9,000 points**, and a **50% chance** of paying **1,000 points**.

For example, if you choose to pay 2,000 points for a lottery ticket, and this question is chosen for payment, you will:

- Pay 2,000 points for the lottery ticket
- Keep 8,000 points for yourself
- Earn whatever proceeds you get from the lottery ticket (if any)

For each row in the table below, which option would you prefer?

☑ Keep 10,000 points	or	☐ Buy the lottery ticket for 10,000 points and keep the remaining 0 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 9,000 points and keep the remaining 1,000 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 8,000 points and keep the remaining 2,000 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 7,000 points and keep the remaining 3,000 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 6,000 points and keep the remaining 4,000 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 5,500 points and keep the remaining 4,500 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 5,250 points and keep the remaining 4,750 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 5,000 points and keep the remaining 5,000 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 4,750 points and keep the remaining 5,250 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 4,500 points and keep the remaining 5,500 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 4,250 points and keep the remaining 5,750 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 4,000 points and keep the remaining 6,000 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 3,750 points and keep the remaining 6,250 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 3,500 points and keep the remaining 6,500 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 3,250 points and keep the remaining 6,750 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 3,000 points and keep the remaining 7,000 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 2,500 points and keep the remaining 7,500 points
☐ Keep 10,000 points	or	☐ Buy the lottery ticket for 2,000 points and

Figure B.4: WTP, Lottery 2

YouGov

For this question, you **have been given 9,000 points**. You will be offered the opportunity to exchange some of these points for a lottery ticket. This lottery ticket has a **50% chance** of paying you **8,000 points**, and a **50% chance** of paying **2,000 points**.

For example, if you choose to pay 3,000 points for a lottery ticket, and this question is chosen for payment, you will:

- Pay 3,000 points for the lottery ticket
- Keep 6,000 points for yourself
- Earn whatever proceeds you get from the lottery ticket (if any)

For each row in the table below, which option would you prefer?

✓ Keep 9,000 points	or	Buy the lottery ticket for 9,000 points and keep the remaining 0 points
Keep 9,000 points	or	Buy the lottery ticket for 8,000 points and keep the remaining 1,000 points
Keep 9,000 points	or	Buy the lottery ticket for 7,000 points and keep the remaining 2,000 points
Keep 9,000 points	or	Buy the lottery ticket for 6,000 points and keep the remaining 3,000 points
Keep 9,000 points	or	Buy the lottery ticket for 5,500 points and keep the remaining 3,500 points
Keep 9,000 points	or	Buy the lottery ticket for 5,250 points and keep the remaining 3,750 points
Keep 9,000 points	or	Buy the lottery ticket for 5,000 points and keep the remaining 4,000 points
Keep 9,000 points	or	Buy the lottery ticket for 4,750 points and keep the remaining 4,250 points
Keep 9,000 points	or	Buy the lottery ticket for 4,500 points and keep the remaining 4,500 points
Keep 9,000 points	or	Buy the lottery ticket for 4,250 points and keep the remaining 4,750 points
Keep 9,000 points	or	Buy the lottery ticket for 4,000 points and keep the remaining 5,000 points
Keep 9,000 points	or	Buy the lottery ticket for 3,750 points and keep the remaining 5,250 points
Keep 9,000 points	or	Buy the lottery ticket for 3,500 points and keep the remaining 5,500 points
Keep 9,000 points	or	Buy the lottery ticket for 3,250 points and keep the remaining 5,750 points
Keep 9,000 points	or	Buy the lottery ticket for 3,000 points and keep the remaining 6,000 points
Keep 9,000 points	or	Buy the lottery ticket for 2,500 points and keep the remaining 6,500 points
Keep 9,000 points	or	Buy the lottery ticket for 2,000 points and keep the remaining 7,000 points
Keep 9,000 points	or	✓ Buy the lottery ticket for 1,500 points and

Figure B.5: Selecting Color that pays off, Urn, Lottery 1

YouGov

Section 11 of 16

This section asks you to make choices that depend on drawing balls from a large, virtual jar. The jar contains 100 balls, 50 of which are blue and 50 of which are brown.

Which color would you prefer to be paid **10,000 points** for (if it is drawn from the large jar)? Note that this means you will be paid 0 points if the other color is drawn.

- Blue
- Brown

Figure B.6: Selecting Color that pays off, Urn, Lottery 2

YouGov

This section asks you to make choices that depend on drawing balls from another different large, virtual jar. The jar contains 100 balls, 50 of which are orange and 50 of which are white.

Which color would you prefer to be paid **8,000 points** for (if it is drawn from the large jar)? Note that this means you will be paid 0 points if the other color is drawn.

- Orange
- White

Figure B.7: Urn, Lottery 1

YouGov

You have chosen to be paid **10,000 points if a brown ball** is drawn and **0 points if a blue ball** is drawn.

For each row in the table below, which option would you prefer?

☑	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	-1,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	0 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	1,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	2,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	2,500 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	3,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	3,250 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	3,500 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	3,750 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	4,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	4,250 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	4,500 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	4,750 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	5,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	5,250 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	5,500 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	6,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	8,000 points
☐	A draw from the jar with 50 blue balls and 50 brown balls	or	☐	10,000 points
☐	A draw from the jar with 50 blue	or	☑	12,000 points

Figure B.8: Urn, Lottery 2

YouGov

You have chosen to be paid **8,000 points if a white ball** is drawn and **0 points if a orange ball** is drawn.

For each row in the table below, which option would you prefer?

☑	A draw from the jar with 50 orange balls and 50 white balls	or	☐ -1,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 0 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 1,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 2,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 2,500 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 2,750 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 3,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 3,250 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 3,500 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 3,750 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 4,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 4,250 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 4,500 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 5,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 6,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 7,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☐ 8,000 points
☐	A draw from the jar with 50 orange balls and 50 white balls	or	☑ 9,000 points

Reset Autofill

Figure B.9: Gain, Lottery 1

YouGov

For each row in the table below, which option would you prefer?

☑	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☐	-500 points
☑	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☐	0 points
☑	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☐	500 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	1,000 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	1,250 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	1,500 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	1,750 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	2,000 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	2,250 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	2,500 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	2,750 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	3,000 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	3,250 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	3,500 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	3,750 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	4,000 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	4,500 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	5,000 points
☐	A 50% chance of 5,000 points, and a 50% chance of 0 points	or	☑	5,500 points

Figure B.10: Gain, Lottery 2

YouGov

For each row in the table below, which option would you prefer?

A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	600 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	1,000 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	1,400 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	1,600 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	1,800 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	2,000 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	2,200 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	2,400 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	2,600 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	2,800 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	3,000 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	3,200 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	3,400 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	3,600 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	4,000 points
A 50% chance of 4,000 points, and a 50% chance of 1,000 points	or	4,600 points

Reset

Autofill

Review the instructions

Figure B.11: Loss, Lottery 1

YouGov

For each row in the table below, which option would you prefer?

☑ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 5,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 5,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 4,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 4,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,750 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,250 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,750 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,250 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 1,750 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 1,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 1,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 500 points

Figure B.12: Loss, Lottery 2

YouGov

For each row in the table below, which option would you prefer?

☑ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 5,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 5,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 4,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 4,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,750 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,250 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 3,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,750 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,250 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 2,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 1,750 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 1,500 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 1,000 points
☐ A 50% chance of losing 5,000 points, and a 50% chance of losing 0 points	or	☐ Losing 500 points

Figure B.13: Mixed, Lottery 1

YouGov

For each row in the table below, which option would you prefer?

☑ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 6,000 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 5,000 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 4,000 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 3,000 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 2,500 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 2,000 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 1,750 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 1,500 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 1,250 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 1,000 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 750 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 500 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Losing 250 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ 0 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Gaining 250 points
☐ A 50% chance of winning 5,000 points, and a 50% chance of losing 5,000 points	or	☐ Gaining 500 points

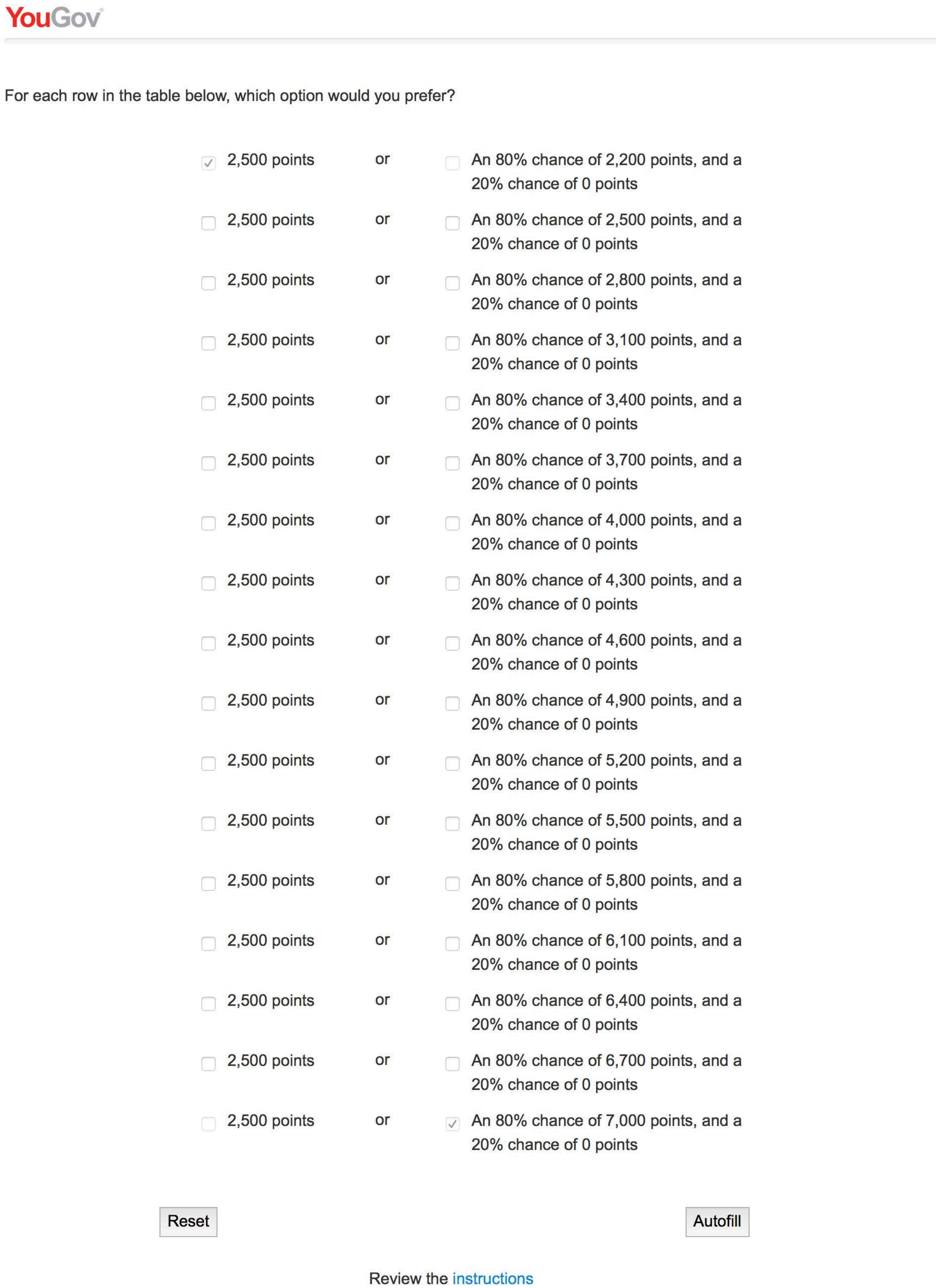
Figure B.14: Mixed, Lottery 2

YouGov

For each row in the table below, which option would you prefer?

☑ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 5,000 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 4,000 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 3,000 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 2,500 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 2,000 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 1,750 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 1,500 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 1,250 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 1,000 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 750 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 500 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Losing 250 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ 0 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Gaining 250
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Gaining 500 points
☐ A 50% chance of winning 4,000 points, and a 50% chance of losing 4,000 points	or	☐ Gaining 1,000 points

Figure B.15: Fixed Money (FM), Lottery 1



YouGov

For each row in the table below, which option would you prefer?

2,500 points	or	An 80% chance of 2,200 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 2,500 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 2,800 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 3,100 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 3,400 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 3,700 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 4,000 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 4,300 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 4,600 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 4,900 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 5,200 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 5,500 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 5,800 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 6,100 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 6,400 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 6,700 points, and a 20% chance of 0 points
2,500 points	or	An 80% chance of 7,000 points, and a 20% chance of 0 points

Reset

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Figure B.16: Fixed Money (FM), Lottery 2

YouGov

For each row in the table below, which option would you prefer?

4,000 points	or	A 75% chance of 3,600 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 4,000 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 4,400 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 4,800 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 5,200 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 5,600 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 6,000 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 6,400 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 6,800 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 7,200 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 7,600 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 8,000 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 8,400 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 8,800 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 9,200 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 9,600 points, and a 25% chance of 0 points
4,000 points	or	A 75% chance of 10,000 points, and a 25% chance of 0 points

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Figure B.17: Two Lotteries (2L), Lottery 1

YouGov

Reminder: As with previous comparisons, the choice on the left side of the list is the same in every row.

For each row in the table below, which option would you prefer?

☑ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 2,200 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 2,500 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 2,800 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 3,100 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 3,400 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 3,700 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 4,000 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 4,300 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 4,600 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 4,900 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 5,200 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 5,500 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 5,800 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 6,100 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 6,400 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☐ A 20% chance of 6,700 points, and an 80% chance of 0 points
☐ A 25% chance of 2,500 points and a 75% chance of 0 points	or	☑ A 20% chance of 7,000 points, and an 80% chance of 0 points

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Figure B.18: Two Lotteries (2L), Lottery 2

YouGov

Reminder: As with previous comparisons, the choice on the left side of the list is the same in every row.

For each row in the table below, which option would you prefer?

☑	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☐	A 15% chance of 3,600 points, and an 85% chance of 0 points
☑	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☐	A 15% chance of 4,000 points, and an 85% chance of 0 points
☑	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☐	A 15% chance of 4,400 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 4,800 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 5,200 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 5,600 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 6,000 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 6,400 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 6,800 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 7,200 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 7,600 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 8,000 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 8,400 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 8,800 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 9,200 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 9,600 points, and an 85% chance of 0 points
☐	A 20% chance of 4,000 points and an 80% chance of 0 points	or	☑	A 15% chance of 10,000 points, and an 85% chance of 0 points

Reset

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Review the instructions

Figure B.19: FM–Mixed, Lottery 1

YouGov

For each row in the table below, which option would you prefer?

0 points	or	A 50% chance of losing 10,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 9,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 8,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 7,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 6,500 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 6,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 5,500 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 5,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 4,500 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 4,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 3,500 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 3,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 2,500 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 2,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 1,500 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of losing 1,000 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of 0 points, and a 50% chance of gaining 5,000 points
0 points	or	A 50% chance of gaining 1,000 points, and a 50% chance of gaining 5,000 points

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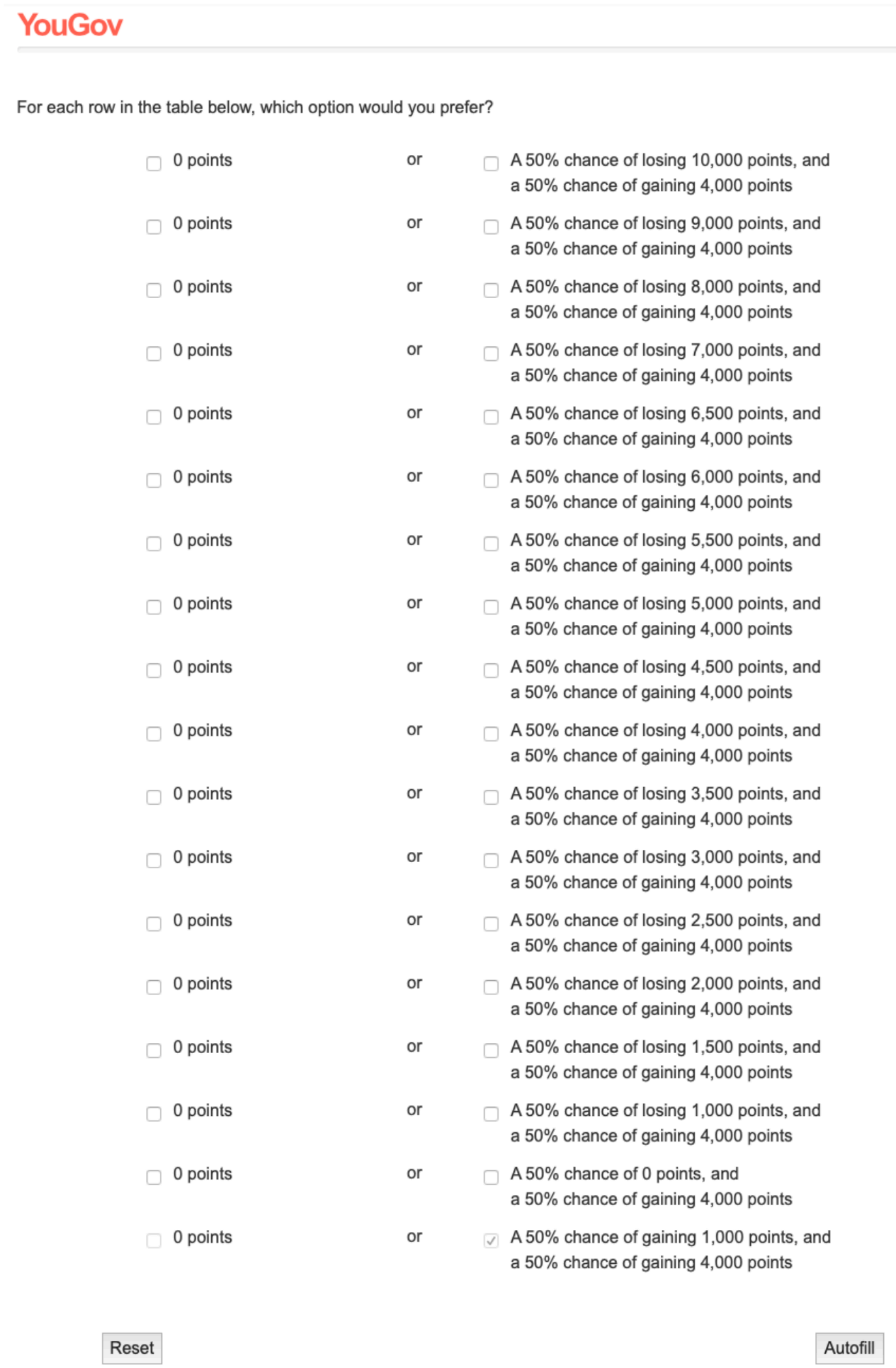
Figure B.20: FM–Mixed, Lottery 2



YouGov

For each row in the table below, which option would you prefer?

☐ 0 points	or	☐ A 50% chance of losing 10,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 9,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 8,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 7,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 6,500 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 6,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 5,500 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 5,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 4,500 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 4,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 3,500 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 3,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 2,500 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 2,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 1,500 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of losing 1,000 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☐ A 50% chance of 0 points, and a 50% chance of gaining 4,000 points
☐ 0 points	or	☑ A 50% chance of gaining 1,000 points, and a 50% chance of gaining 4,000 points

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Figure B.21: Qualitative Self-Assessment of Risk Aversion

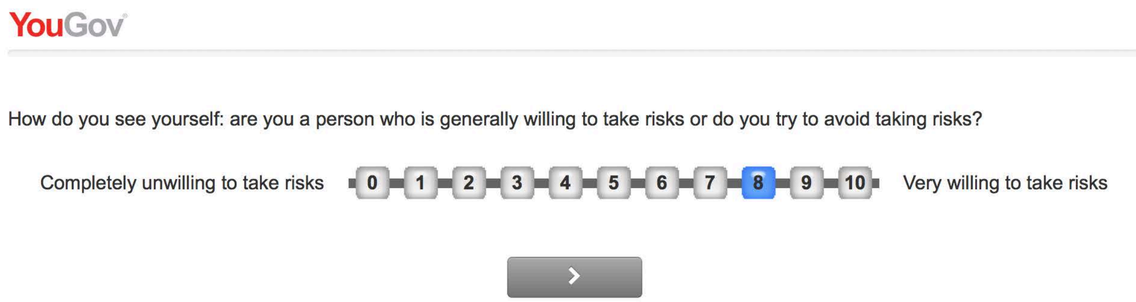


Figure B.22: Example of a Choice in DOSE

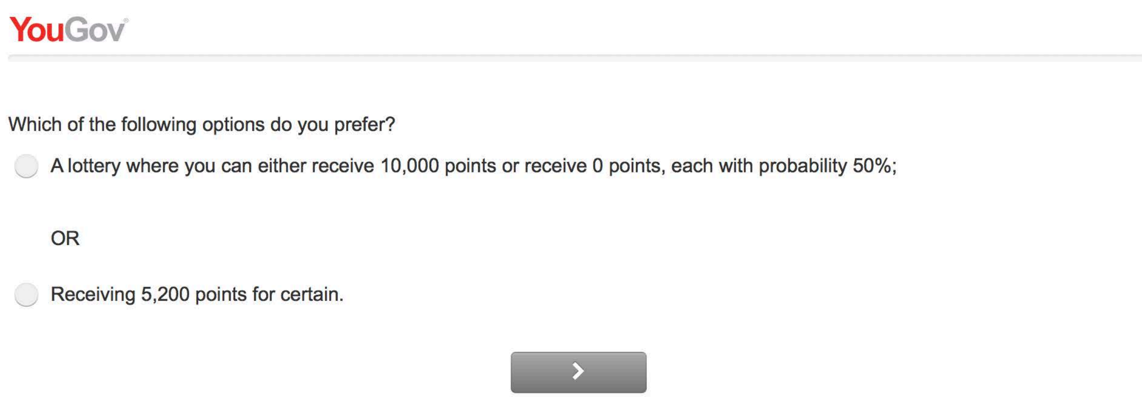


Figure B.23: Example of warning given to participants when they made a dominated choice.

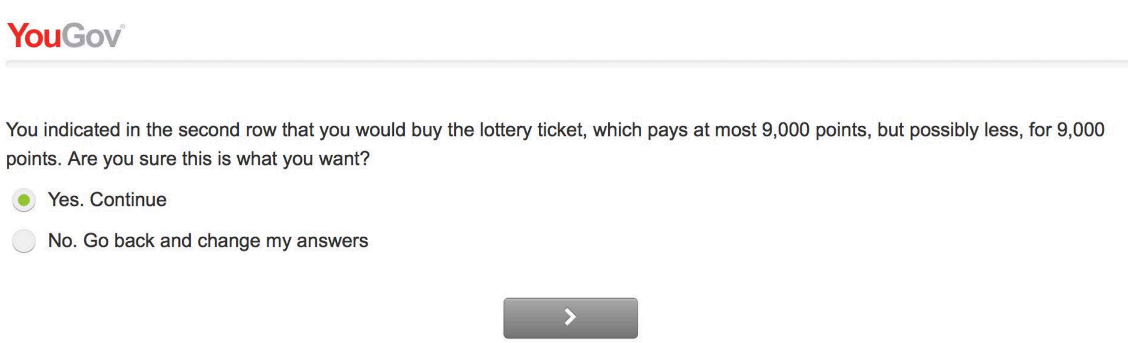
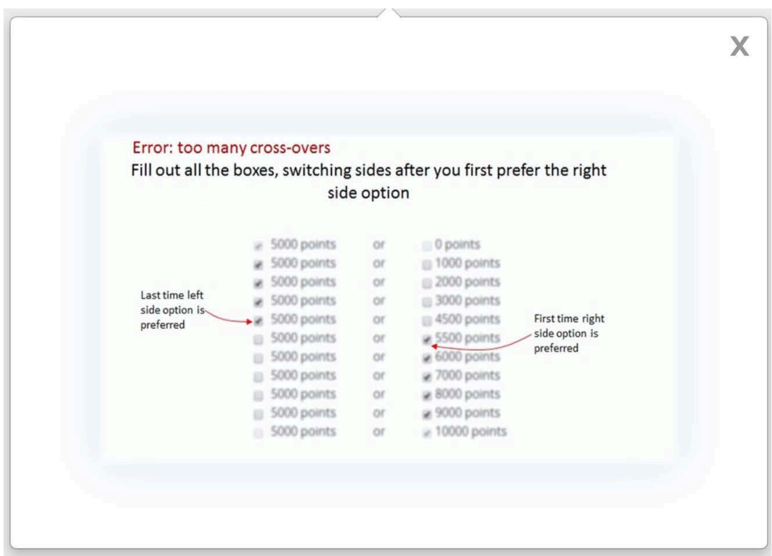


Figure B.24: Example of error given when participants tried to proceed with multiple crossovers.



C Details of Randomization

Approximately half of the participants received the WTA questions first, and the other half the WTP questions first. In Study 1, Wave 1, these questions appeared in the second and seventh block of questions (out of 11). The same positions were used in Wave 2, but the randomization over the ordering of WTA and WTP was conducted independently of the first wave. In Study 2, these questions appeared in the third and seventh block (out of 12). A qualitative question about an unrelated topic was asked between the two elicitations of WTA, and also between the two elicitations of WTP.

C.1 Mechanical Explanations for Low Correlation

Examining the screenshots above shows that if a user always clicked, say, the third from the top box in each MPL it would induce a negative correlation between WTA and WTP. This is not a particular concern due to the fact that results are robust to excluding those that give extreme answers, as these people are the most likely to follow such a pattern. However, here we conduct more extensive checks that control explicitly for the average position a participant chooses on non-risk related MPLs, including analyzing the data of an additional large scale study that reversed the order of the MPL for WTP.

In particular, as the questions about WTA and WTP are far apart in the study, any issue caused by people picking different points on an MPL would be more likely due to a tendency, rather than an explicit position chosen on each MPL. Thus, if we control for such a tendency, this should get rid of spurious correlation (or lack thereof) created by the ordering of the MPLs. To do so, we need a measure of this tendency. This is easily obtained from the other MPLs in our studies, especially Study 2, which contains a number of MPLs that measure something other than risk attitudes.[1] We use, as a control for this tendency, the location of the switching point on six MPLs unrelated to risk in Study 2: two regarding time preference, and four regarding social preferences (two in the advantageous domain and two in the disadvantageous domain). For each of these MPLs we identify the first row in which the participant clicked the right hand side the MPL (if individuals never switched they are assigned a value of the last row number plus one).

[1]Risk measures are correlated with WTA and WTP for lotteries—see Section 4.4. Thus, including the MPL positions on those measures would add error to the average position variables, as some of the variation in that variable will represent real correlations between risk measures and WTA/WTP.

We control for a general tendency to select answers in higher or lower spots on an MPL in several ways in Table C.1. All columns examine the correlation between the Average WTA and Average WTP measures from Study 2 (where we have the most controls for MPL position). The first column shows the unconditional correlation from a standardized regression. The next four columns enter information about other choices in various ways. The second column includes the first three principal components of the switching rows. The first principal component is essentially an average, and the others contain more information about choices in these other MPLs. Together, the first three principal components capturing 85% of the variation in MPL switching point location. The third column breaks each of these three components into deciles, and then enters a dummy variable for each decile. This is 30 dummy variables in all. The fourth column breaks the first principal component into 100 percentile bins, and enters a dummy for each. Both of these allow for a more non-parametric dependence of the correlation on average choice. The final column enters a dummy variable for each possible switching position in each of the six MPLs. Across all columns and both panels the pattern is clear: the partial correlation barely moves no matter how we try to control for the average position a participant takes on other MPLs.

We can look at this issue one other way. Those that are most wedded to a given position on the MPL will have a lower standard deviation of switching points. If switching points are just random, with a person-specific parameter deciding where on the MPL they chose to switch, then we should see a positive relationship between the standard deviation of switching points and the correlation between WTA and WTP.

Figure C.25 shows the correlation between WTA and WTP as a function of the standard deviation of MPL switching points. To produce the figure, we generate a variable for person i that describes their contribution to the correlation in their percentile p as

$$\frac{(\mathrm{WTA}_i - \overline{\mathrm{WTA}}_p)(\mathrm{WTP}_i - \overline{\mathrm{WTP}}_p)}{(\mathrm{Var}[\mathrm{WTA}_p]\mathrm{Var}[\mathrm{WTP}_p])^{\frac{1}{2}}}.$$

This can then be plotted, non-parametrically, versus the percentile of the standard deviation. The black lines indicate the non-parametric plot, and the grey bar indicates the 95% confidence intervals.

The first panel of Figure C.25 does not smooth the correlations across percentiles. As such, there does not seem to be an apparent pattern. Therefore, in the second panel, we

Table C.1: Partial correlations controlling for average MPL switching position on non-risk questions.

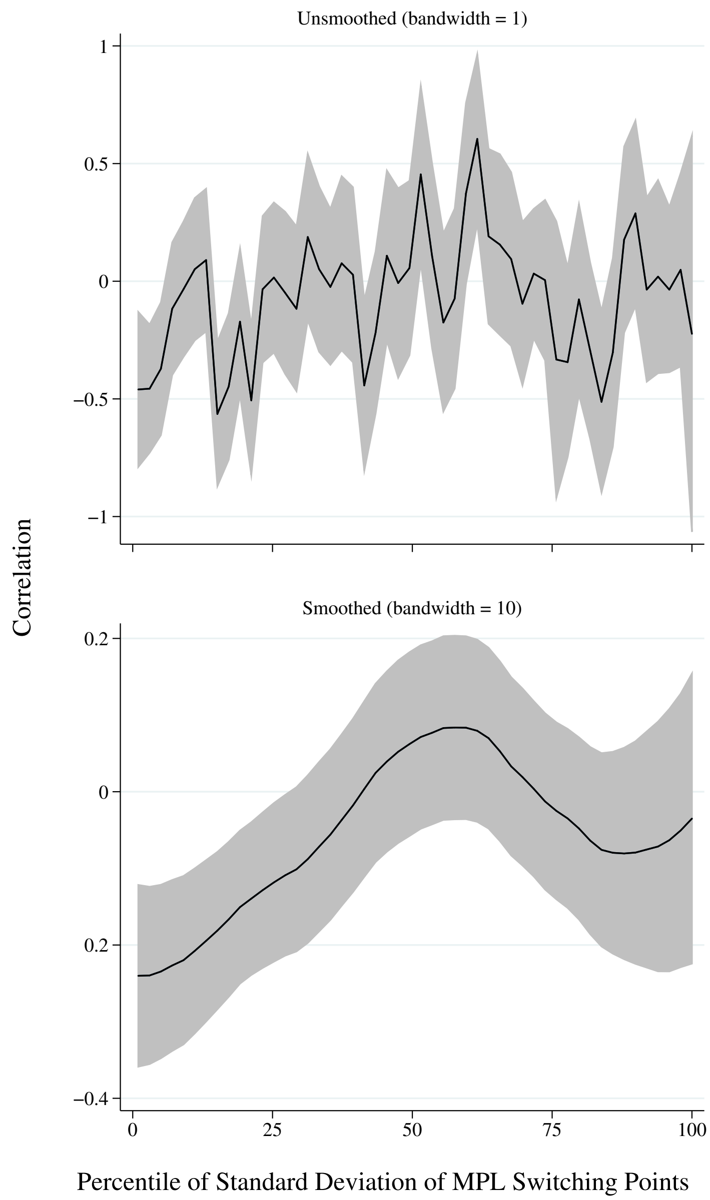
Dependent Variable: Average WTP					
Average WTA	−0.09 (.057)	−0.04 (.052)	−0.04 (.047)	−0.05 (.046)	−0.05 (.037)
Three Principal Components		Y			
Deciles of First 3 Principal Components			Y		
Percentiles of First Principal Component				Y	
Indicators for Switching Point in six Questions					Y
Dependent Variable: Average WTA					
Average WTP	-0.09 (.059)	-0.04 (.056)	-0.05 (.051)	-0.06 (.049)	-0.05 (.040)
Three Principal Components		Y			
Deciles of First 3 Principal Components			Y		
Percentiles of First Principal Component				Y	
Indicators for Switching Point in six Questions					Y

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, with standard errors in parentheses.

smooth the non-parametric plot. As can be seen, those that have very little variation in their MPL switching point do, indeed, exhibit a negative correlation between WTA and WTP. However, above the 25th percentile, there is a non-monotonic relationship between the correlation of WTA/WTP and the standard deviation of MPL switching points. Indeed, the non-parametric curve never exceeds 0.07, and the 95% confidence interval never exceeds 0.2. The average correlation above the 25th percentile is 0.00. Thus, any effect of MPL ordering on our results is likely to be quite small.

As a final test, as part of another study, a subset of the coauthors experimentally varied whether or not WTP was elicited using the standard ordering, featured throughout this

Figure C.25: Correlation as a function of standard deviation of switching points.



paper, or the opposite ordering. This study was administered to a non-representative subset of the British population (Carvalho, Ortoleva, Perez-Arce, and Snowberg, 2017). Analysis of this data, in the style of Table 3, is shown in Table C.2.

There are a number of salient features of the data. First, the correlations using the standard ordering are about 0.1 to 0.15 higher than found in our study. As discussed in Section B, this difference is likely due to a different population being studied. Second, using the alternate ordering increases correlations by 0.1 to 0.15. Finally, as there does not seem

Table C.2: Reversing the order of the WTP MPL.

		Correlation between WTA and WTP				Correlation within Type	
	N	Lottery 1	Lottery 2	Averages	ORIV	WTA	WTP
Standard Order	1,037	0.05 (.035)	0.03 (.038)	0.05 (.036)	0.06 (.044)	0.69*** (.030)	0.72*** (.031)
Reverse Order (WTP)	953	0.15*** (.039)	0.18*** (.039)	0.18*** (.037)	0.22*** (.046)	0.74*** (.029)	0.64*** (.041)
All Data	1,990	0.10*** (.027)	0.10*** (.027)	0.11*** (.026)	0.13*** (.031)	0.71*** (.021)	0.69*** (.025)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, with bootstrapped standard errors from 10,000 simulations in parentheses.

to be a "correct" ordering for these MPLs, the row gives what is essentially an average of the first two rows. A final point worth noting is the distribution of endowment effects is virtually unchanged by reversing the order of the WTP MPL. Thus, had we altered the ordering of the WTP MPL in our studies, it is likely that the correlation we observed would be much closer to zero, while other results would remain virtually unchanged.

However, the effect of reversing the MPL order seems to not just change answers, it seems to change the composition of the people completing the survey. Although each ordering was administered to 50% of the sample population, about 10% fewer people completed the alternate version. This seems to be because people found the alternate version so confusing they dropped out of the study altogether. An additional piece of evidence is the much lower correlation between WTP measures when using the alternative ordering. This suggests that an increase of 0.15 in the correlations due to changing the order of the MPL is an upper bound, as some of this change is likely due to a change in the composition of the people completing the survey.