Willingness to Accept, Willingness to Pay, and Loss Aversion*

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Abstract

We study the endowment effect—the divergence between Willingness to Accept (WTA) and Willingness to Pay (WTP)—using three incentivized, representative surveys of 4,000 U.S. adults. We find that the endowment effect is uncorrelated with loss aversion for risky prospects, contrary to the prediction of leading theories, such as Prospect Theory. We then document three additional novel findings about the relationship between WTA and WTP, and use them to narrow the space of plausible theories of the endowment effect. First, WTA and WTP are, at best, weakly correlated. Second, around 30% of participants exhibit a negative endowment effect—WTP>WTA. Third, WTA and WTP for lotteries strongly relate to other aspects of risk preferences. Out of theories that cover both the endowment effect and risk preferences, only Cautious Utility is consistent with all of these findings.

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1 Introduction

A foundational finding in behavioral economics is the *endowment effect*—the observation that an individual's minimum Willingness To Accept (WTA) money for a good is typically higher than their maximum Willingness To Pay (WTP) money for the same good. Since Kahneman, Knetsch, and Thaler (1990), the endowment effect is generally modeled as a consequence of *loss aversion*—the assumption that the disutility from a loss exceeds the utility from an equivalent gain—leading to the prediction that the endowment effect is correlated with *loss aversion for risky prospects*.[1] Loss aversion remains "the leading paradigm for understanding the endowment effect" (Ericson and Fuster, 2014, p.574). Moreover, loss aversion was chosen as the "most plausible" explanation of the endowment effect by 76% of respondents to an expert survey, besting, by 46 percentage points, the next closest contender, "Differential focus / salience / query theory."[2] Yet, few studies have tested the existence of a relationship between the endowment effect and loss aversion, and there is little empirical evidence supporting this key theoretical proposition.

This paper tests this proposition and does not find support for the theorized link between the endowment effect and loss aversion for risky prospects across three incentivized surveys in representative samples of the U.S. population (combined $N = 4{,}000$). We elicit multiple individual-level measures of each variable, and, across a range of elicitations, specifications, and samples, we find that, if a positive correlation between the two exists, it is only in small subgroups of the population using specific measures, and quite limited in magnitude. We then add three additional novel findings about the relationship between WTA, WTP, and measures of risk preferences, establishing a set of facts that narrow the space of alternative theories of the endowment effect. First—contrary to expert predictions—WTA and WTP are either uncorrelated or weakly negatively correlated. Second, a substantial minority of participants (around 30% in each of our samples) exhibit a negative endowment effect. Although previously undocumented, this rate is similar in our reanalysis of the data from the five prior studies that have used within-person designs to study the endowment effect for lotteries. Third, WTA and WTP for lotteries are strongly related to independent clusters of other risk measures—with correlations that reach magnitudes of up to 0.66. Out of the theories of the endowment effect and risk preferences, only Cautious Utility is consistent with all of these findings, although this may only indicate the need for further theorizing.

The endowment effect is prominent in economics because it interferes with the efficiency of

[1] As introduced in Kahneman and Tversky (1979b), loss aversion should manifest as a change in risk aversion around a reference point—we refer to this phenomenon as *loss aversion for risky prospects* throughout the paper.

[2] We investigated economists' views of the endowment effect via a prediction survey (DellaVigna, Pope, and Vivalt, 2019) implemented on the Social Science Prediction Platform (socialscienceprediction.org/predict/) between March 31 and June 30, 2024 ($N = 104$). Among other questions (some of which are discussed below), participants were asked to identify the theory or theories of the endowment effect they considered the "most plausible." Three-quarters (76%) of respondents selected "Loss aversion", more than twice as many as the closest contenders, "Differential focus / salience / query theory" (30%), and "Motivated taste change" (25%). See Appendix A.3 for details.

markets—it implies that there are ranges of prices in which people are unwilling to trade. A better understanding of its causes is critical to developing policies to avoid or mitigate such problems.[3] Our findings suggest that the endowment effect is driven by the complexity of choice or uncertainty about personal valuations—as implied by, for example, Cautious Utility—rather than by strong attachment to goods—as implied by loss aversion. Consequently, the endowment effect may be reduced by providing better information about the characteristics of the items being exchanged. Both these implications are supported by empirical regularities: the endowment effect is particularly frequent for products that are further from "ordinary market goods" (see the meta-study of Horowitz and McConnell, 2004), and a long list of experiments have shown that the endowment effect is strongly affected by information (Shogren et al., 1994; List, 2004; Weaver and Frederick, 2012). Further investigation of these regularities, in addition to our findings, may be helpful in constructing more accurate theories of the endowment effect, and more specific policies on how to mitigate it.

The Endowment Effect from Loss Aversion. The most common theory of the endowment effect in economics ascribes it to loss aversion (Ericson and Fuster, 2014; Barberis, 2018). Introduced in Kahneman and Tversky (1979b) to study risk preferences, loss aversion manifests as an increase in risk aversion for lotteries that involve both gain and losses. Kahneman, Knetsch, and Thaler (1991) propose that if selling a good is encoded as a loss of that item, then loss aversion implies that WTA is greater than WTP, with more loss averse individuals exhibiting a larger endowment effect. Under this model, the endowment effect is related to loss aversion as measured in risky prospects. This relationship is also predicted by theories that extend reference-dependence preferences to lotteries, such as stochastic reference dependence (Kőszegi and Rabin, 2006, 2007) or Third-Generation Prospect Theory (Schmidt, Starmer, and Sugden, 2008). Consequently, as evidenced by our expert survey, "[L]oss aversion remains the most prominent explanation of the [endowment] effect" (Barberis, 2018, p.670).

Our Data. Our data come from three incentivized surveys of representative samples of the U.S. population. The first includes 2,000 participants who were contacted in early 2015. The second and third each include 1,000 independent participants, and were fielded in 2016 and 2020. To capture the preferences of demographic groups that are generally underrepresented or overlooked in samples drawn from student populations or crowdsourcing websites, we use the services of YouGov,

[3] The existence of an endowment effect means that initial allocations of property rights or entitlements affect bargaining outcomes, contrary to the predictions of the Coase Theorem. Consequently, the endowment effect has been widely cited in legal scholarship, in settings ranging from cap-and-trade emission trading systems to rights for disability accommodations—see Klass and Zeiler (2013, especially pp.23–25) for a (somewhat skeptical) review. The endowment effect also complicates welfare analyses, as it is not clear whether WTA or WTP is the more appropriate valuation metric (Knetsch, Riyanto, and Zong, 2012).

a commercial survey company.[4] In each survey, we measure the WTA and WTP for two lottery tickets. Across the surveys, there are three different measures of loss aversion for risky prospects, and six different measures of risk preferences. Thus, we demonstrate the robustness of the endowment effect across the general population, while providing reassurance that the lack of correlations we observe is not an artifact of a particular sample or measure.

We focus on WTA and WTP for monetary lottery tickets for three main reasons. First, this maximizes the probability of finding a relationship between the endowment effect and loss aversion for risky prospects, as the two are measured on the same dimension—money. If we measured the endowment effect for a mug and loss aversion for monetary gambles, a lack of correlation could be explained by different and unrelated loss aversion for money and for mugs. This issue does not arise with monetary lotteries. Second, the previous literature has established robust evidence of an endowment effect for lotteries both in the lab (see Horowitz and McConnell, 2004 and Marzilli Ericson and Fuster, 2014 for reviews) and in the field (Anagol, Balasubramaniam, and Ramadorai, 2018), reaching back to the first experimental study of the endowment effect (Knetsch and Sinden, 1984).[5] Third, it is feasible to implement in online surveys. Indeed, our study provides what may be the most substantial evidence for an individual-level endowment effect—such an effect exists in each of our large representative samples, and within every subgroup we examine, see Appendix Tables D.3 and D.4.[6]

This data allows us to document four findings, which we use to test theories of the endowment effect. Finding 1—our main result—shows that explanations of the endowment effect based on loss aversion are incompatible with our data. To further narrow the space of plausible theories, we then present three additional findings regarding the relationship between WTA and WTP for lotteries. First, WTA and WTP are largely independent in our data. Second, a significant minority of individuals exhibit a negative endowment effect. Third, WTA and WTP relate to different clusters of risk attitudes. Section 5 draws on these findings to assess alternative theories of the endowment effect and risk preferences.

[4]In our (weighted) sample, 40% of participants have attained no more than high school education, in comparison to 38% reported in the 2020 American Community Survey, and just 11% on Prolific (Gupta, Rigotti, and Wilson, 2021, we thank Neeraja Gupta for sharing this figure). YouGov builds nationally representative samples through targeted quota sampling from a two-million-person panel and by constructing sample weights—producing better representative samples than other non-probability sampling procedures, and performing better than traditional probability sampling in eliciting attitudes (Pew Research Center, 2016, YouGov is Sample I). See Stantcheva (2022) for a general discussion of the advantages of running studies with online panels.

[5]Knetsch and Sinden (1984) studied lotteries, inspired by earlier survey evidence of large WTA–WTP disparities for recreational use goods, such as fishing and hunting licenses, which are effectively lotteries over valued outcomes such as catches and kills (Meyer, 1979).

[6]Most studies of the endowment effect use a between-subjects design—some participants buy, and some sell—and find that the distribution of WTA first-order stochastically dominates the distribution of WTP. Instead, our study is within-participant—each participant buys and sells two lottery tickets.

Finding 1: The Endowment Effect is Not Correlated with Loss Aversion for Risky Prospects. In our data, the endowment effect is not related to loss aversion for risky prospects. This holds if we define the endowment effect either as the ratio of, or difference between, WTA and WTP; if we use any of our three different measures of loss aversion for risky prospects; if we disaggregate by survey or lottery ticket; if we control for risk aversion in several possible ways; if we exclude participants most likely to be inattentive; or if we control for measurement error using various methods, including an instrumental-variable approach that provides consistent estimates in the presence of measurement error (Gillen, Snowberg, and Yariv, 2019, ORIV). There is little evidence of a positive correlation within any demographic subgroup we examine, with the exception of participants with the highest 5–10% of a measure of IQ. Among these participants we observe suggestive, but noisy, evidence of a small positive correlation—a result which helps us connect our study to the prior literature.

Finding 2: WTA and WTP are Either Uncorrelated or Weakly Negatively Correlated. In our data, WTA and WTP are not only different: they are, at best, weakly related to each other. Knowing WTA conveys almost no information about WTP—contrary to the predictions of our experts, of whom 77% anticipated a positive relationship between the two measures. This result is consistent across numerous subgroups, and, importantly, it is not due to noise in our measures. This finding suggests that WTA and WTP for lotteries are likely independent objects, rather than deviations from a shared underlying valuation.

Finding 3: A Consistent ∼30% of Participants Exhibit WTA Below WTP. A substantial minority—around 30%—of our participants exhibit a negative endowment effect (that is, their WTP > WTA). Of those who express a negative (positive) endowment effect in one lottery, 65% (71%) also express a negative (positive) endowment effect in the second. Moreover, the rate of negative endowment effects is relatively constant across every demographic subgroup we examine, and within our own student samples. We also re-analyze data from the five studies we are aware of that use a within-participant design to study WTA and WTP for lotteries, and find that 29% of participants, on average, exhibit a negative endowment effect. This stability across lotteries, subgroups, and populations suggests that the presence of a negative endowment effect is more than just noise. Despite this, the phenomenon has not, to our knowledge, been discussed or reported in earlier studies. This finding indicates that theories should accommodate heterogeneity in the direction as well as the magnitude of the endowment effect.

Finding 4: WTA and WTP Relate to Different Clusters of Risk Preferences. Our surveys encompass several measures of risk preferences, including both the certainty equivalents of lotteries and the lottery equivalents of sure amounts, or of other lotteries. WTA is strongly related to certainty equivalents, whereas WTP is strongly related to lottery equivalents. However, these different types of risk elicitations are not related to each other. Overall, our measures have a very clear structure, in which risk preferences exhibit two clear clusters, with strong correlation within and weak correlation across. Remarkably, WTA and WTP belong to different clusters. A possible explanation for these clusters, drawing on the approach of Hershey and Schoemaker (1985) and Sprenger (2015), is that the fixed option in a Multiple Price List (MPL) acts as an endowment. Under this interpretation, measured risk attitudes depend on whether one is (explicitly or implicitly) buying or selling a lottery. Together with Finding 2, this suggests that studying buying and selling as separate and largely independent processes is a fruitful avenue for future research.

Alternative Theories of the Endowment Effect. We use these findings to analyze theories of the endowment effect and risk preferences. Among the many models of the endowment effect and risk preferences, we are aware of only three that study both the endowment effect and loss aversion for risk: Prospect Theory and its derivatives, Salience, and Cautious Utility. Prospect Theory is incompatible with Finding 1, as discussed above. Cautious Utility is consistent with all of our findings, but Salience does not appear to be.

In Cautious Utility (Cerreia-Vioglio, Dillenberger, and Ortoleva, forthcoming), individuals are unsure about trade-offs and apply *caution*. When they are unsure about the dollar value to assign to a good, such as a lottery, but think it is in some range, caution generates the endowment effect. In particular, an individual will not sell for less than the highest value of the range, and they also will not pay more than the lowest value. Loss aversion for risky prospects emerges when an individual is unsure how to aggregate gains and losses, as caution pushes them away from options with both. Thus, both effects may emerge, but they remain distinct and independent—each may be present without the other. WTA and WTP will be uncorrelated if the variation in the top range of possible valuations is independent of that in the bottom range. Moreover, Cerreia-Vioglio, Dillenberger, and Ortoleva (forthcoming) explicitly contemplate a case in which individuals use the opposite of caution, yielding a negative endowment effect. Thus, overall, our findings are compatible with Cautious Utility.

Related Literature. Our findings relate to several strands of the literature, discussed in detail in Section 6. We are aware of only three other papers that test the relation between the endowment effect and loss aversion for risky prospects, as we do in Finding 1. The two studies in large representative samples (ours and Fehr and Kübler, 2022) find no relationship, whereas two studies in smaller convenience samples (Dean and Ortoleva, 2019; Gächter, Johnson, and Herrmann, 2022) find a positive correlation. This pattern suggests that mixed results across these papers may stem from examining different populations.[7] Findings 2 and 3 are consistent with results obtained from reanalyzing available data from the small number of previous studies that elicited within-subject estimates of WTA and WTP—although few of these prior studies report the correlation and none report the share of participants with a negative endowment effect. Finding 4 relates to a literature on multidimensionality of risk preferences, and to papers discussing how MPL-based elicitations may induce reference effects.

2 Theory: The Endowment Effect from Loss Aversion

The most common explanation of the endowment effect in economics ascribes it to loss aversion, as modeled in Prospect Theory (Kahneman, Knetsch, and Thaler 1990; Tversky and Kahneman 1991; see O'Donoghue and Sprenger 2018 for a review). In the classical approach, devised to explain the endowment effect for risk-free goods such as mugs, individuals evaluate a bundle x relative to a reference bundle r with utility $U(x|r) = \sum_i V_i(x_i - r_i)$, where the utility in each dimension i is such that $V_i(x_i - r_i) = -\lambda V_i(r_i - x_i)$ if $x_i < r_i$. The parameter $\lambda \in \mathbb{R}_+$, which may also be dimension-specific, is generally assumed to be larger than 1, and captures *loss aversion*. This parameter represents an asymmetry in the treatment of gains and losses, and was originally used to describe the increase in risk aversion when a risky prospect includes a loss in addition to gains (Kahneman and Tversky, 1979a).

If the reference point is a person's endowment, loss aversion leads to the endowment effect. The maximum amount the agent is willing to pay (WTP) to acquire a good that gives utility G, and the minimum they are willing to accept (WTA) to forgo it, are

$$u(\text{WTA}) - \lambda G = 0 \quad \Rightarrow \quad \text{WTA} = u^{-1}(\lambda G)$$
$$-\lambda u(\text{WTP}) + G = 0 \quad \Rightarrow \quad \text{WTP} = u^{-1}(G/\lambda)$$

in which u denotes the utility of money. The endowment effect is due to loss aversion λ, but modulated by the curvature of u. Indeed, WTA $\geq$ WTP if and only if $\lambda \geq 1$.

To model the endowment effect for lottery tickets, we need to extend this formulation to the case in which the endowed good is a lottery. The simplest way to do so is to treat lotteries as simply a good with expected utility G.[8] A more common approach in the recent literature is to allow the lottery to create a stochastic reference point and follow the model of Kőszegi and Rabin (2006; 2007; henceforth KR). In this formulation, a lottery p is evaluated relative to a reference lottery q

[7]Fehr and Kübler (2022) was begun after our initial working paper of this paper, while the two in convenience samples predate that draft.

[8]While this has the benefit of simplicity, applying this to degenerate lotteries implies an endowment effect for money.

by considering each possible realization of p and q as if they are independent. That is

$$U(p|q) = \sum_x \sum_r U_{\text{KR}}(x|r)p(x)q(r)$$

where it is typically assumed[9] that $U_{\text{KR}} : \mathbb{R} \times \mathbb{R} \to \mathbb{R}$ is

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

In this formulation, each outcome is evaluated as the sum of consumption utility u and gain-loss utility, in which $\eta \in \mathbb{R}_+$ determines the relative weight of each. In our setting, payoffs are only over money, so u is the utility of money, and λ captures the overweighting of losses in loss aversion. Following the standard approach of assuming linear u for small stakes (see Kőszegi and Rabin, 2006, 2007; Sprenger, 2015; O'Donoghue and Sprenger, 2018), the WTA and WTP for a lottery ticket that pays $h > 0$ or 0 with equal probability are:

$$\begin{aligned} \frac{1}{4}\big(h - \eta\lambda h + h + \eta h\big) = \frac{1}{2}\big(\text{WTA} + \eta\lambda(\text{WTA} - h)\big) + \frac{1}{2}\big(\text{WTA} + \eta\text{WTA}\big) \quad &\Rightarrow \quad \text{WTA} = \frac{h}{2} \\ \frac{1}{2}\big(h - \text{WTP} + \eta(h - \text{WTP})\big) + \frac{1}{2}\big(-\text{WTP} - \lambda\eta\text{WTP}\big) = 0 \quad &\Rightarrow \quad \text{WTP} = \frac{h}{2}\frac{1+\eta}{1+\eta\lambda} \\ &\Rightarrow \quad \frac{\text{WTA}}{\text{WTP}} = \frac{1+\eta\lambda}{1+\eta}. \end{aligned}$$

Once again, the endowment effect is due to loss aversion λ. Note that the linearity of u in this model implies that WTA is just the expected value of the lottery, and hence should not vary. This can be corrected, at some cost to complexity, by allowing for heterogeneity in the curvature of u.[10]

Another approach to stochastic reference points is taken by Third-Generation Prospect Theory (Schmidt, Starmer, and Sugden 2008; henceforth 3PT). In this model, a lottery p is evaluated

[9]Although rarely used in applications (see O'Donoghue and Sprenger, 2018, p. 16), it is possible to allow for diminishing sensitivity: $U_{KR}(x|r) = u(x) + \eta\mu\,(u(x) - u(r))$, with μ a strictly increasing function that satisfies the conditions that guarantee loss aversion (Kőszegi and Rabin, 2006, 2007). This does not change any of the conclusions, but complicates the algebra; following standard practice, we therefore assume μ is linear.

[10]If u exhibits constant relative risk aversion (CRRA), $u(x) = x^\alpha$ for $x > 0$ and $u(-x) = -u(x)$:

$$\begin{aligned} \frac{1}{4}\big(h^\alpha - \eta h^\alpha + h^\alpha + \eta h^\alpha\big) = \frac{1}{2}\big(\text{WTA}^\alpha + \eta\lambda(\text{WTA}^\alpha - h^\alpha)\big) + \frac{1}{2}\big(\text{WTA}^\alpha + \eta\text{WTA}^\alpha\big) \quad &\Rightarrow \text{WTA} = \frac{h}{2^{\frac{1}{\alpha}}} \\ \frac{1}{2}\big((h - \text{WTP})^\alpha + \eta(h - \text{WTP})^\alpha\big) + \frac{1}{2}\big(-\text{WTP}^\alpha - \lambda\eta\text{WTP}^\alpha\big) = 0 \quad &\Rightarrow \text{WTP} = \frac{h}{1 + (\frac{1+\eta\lambda}{1+\eta})^{\frac{1}{\alpha}}}. \end{aligned}$$

Once again, the endowment effect is caused by λ and modulated by α.

relative to the reference lottery q according to

$$U(p|q) = \sum_x \sum_r U_{3PT}(x|r) \mathrm{P}_{p,q}(x,r),$$

in which $\mathrm{P}_{p,q}(x,r)$ is the joint probability that p returns x and q returns r, and

$$U_{3PT}(x|r) = \begin{cases} (x-r)^\beta & \text{if } x \geq r \\ -\lambda\,(r-x)^\beta & \text{if } x < r. \end{cases}$$

One key difference between 3PT and KR is that 3PT accounts for the correlation between the outcome lottery and the reference lottery. In particular, this implies that the value of holding the reference lottery is zero, which is not the case under KR. With this formulation, we obtain

$$0 = \frac{1}{2}\,(h - \mathrm{WTP})^\beta - \frac{\lambda}{2}\,(-\mathrm{WTP})^\beta \Rightarrow \quad \mathrm{WTP} = \frac{h}{1+\lambda^{\frac{1}{\beta}}}$$
$$\Rightarrow \quad \frac{\mathrm{WTA}}{\mathrm{WTP}} = \lambda^{\frac{1}{\beta}}.$$

Thus, in 3PT, WTA is increasing in loss aversion and WTP is decreasing. The endowment effect is, once again, increasing in loss aversion λ.

Measures of Loss Aversion for Risk. Our surveys measure loss aversion for risky prospects in three ways. First, *DOSE-λ* is a direct estimate of λ from a sequence of binary choices, assuming a standard CRRA utility function, as detailed in Section 3. This coincides with classic Prospect Theory or 3PT, with a reference point of zero. As, under all formulations above, the endowment effect is increasing in λ, all predict a positive (and large) correlation between the endowment effect (measured as WTA/WTP) and this measure of loss aversion.

Second, *FM-Mixed* is the lottery equivalent of zero: the (negative) value c that makes individuals indifferent between 0 for sure and a binary lottery that pays with equal probability either $g > 0$ or c. Under classical Prospect Theory and 3PT, assuming a reference point of zero,

$$0 = \frac{1}{2}g^\beta - \frac{1}{2}\lambda(-c)^\beta \quad \Rightarrow \quad c = -g\lambda^{-1/\beta}.$$

Under KR with linear utility,[11]

$$0 = \frac{1}{2}(g + \eta g) + \frac{1}{2}(-c + \eta\lambda(-c)) \Rightarrow \quad c = -g\frac{1+\eta}{1+\eta\lambda}.$$

[11]If u exhibits CRRA, we have $\frac{1}{2}(g^\alpha + \eta g^\alpha) + \frac{1}{2}(-c^\alpha + \eta\lambda(-c^\alpha)) = 0$, giving us $c = -g\left(\frac{1+\eta}{1+\eta\lambda}\right)^{\frac{1}{\alpha}}$.

Thus, under all formulations, c is increasing (becoming less negative) in λ, as is the endowment effect. Thus, this measure of loss aversion should be positively related to the endowment effect.

Third, *Mixed* is the certainty equivalent a (positive or negative) of a 50/50 lottery between identical gains and losses k and $-k$. For classical Prospect Theory and 3PT,

$$a = \begin{cases} -k\left(\frac{\lambda-1}{2\lambda}\right)^{\frac{1}{\beta}} & \text{if } \lambda \geq 1 \\ k\left(\frac{1-\lambda}{2}\right)^{\frac{1}{\beta}} & \text{if } \lambda < 1. \end{cases}$$

For KR with linear utility,[12] we have

$$a = \begin{cases} -k\left(\frac{\eta\lambda-\eta}{1+\eta\lambda}\right) & \text{if } \lambda \geq 1 \\ k\left(\frac{\eta-\eta\lambda}{1+\eta}\right) & \text{if } \lambda < 1. \end{cases}$$

Again, under all formulations, a is increasing in λ, as is the endowment effect, so the two should be positively correlated.

Measures of the Endowment Effect. As noted in the introduction, we focus on the endowment effect for lottery tickets with monetary rewards and loss aversion for risky monetary prospects. This simplifies modeling, as it allows us to adopt a single parameter of loss aversion λ, describing gain-loss trade-offs on the only relevant dimension—monetary amounts. In turn, this allows us to straightforwardly derive testable predictions about the relationship between the endowment effect and loss aversion for risky prospects. If, instead, we computed the endowment effect for physical goods and loss aversion for risky monetary prospects, these may be evaluated using two independent loss aversion parameters. This would not result in a testable prediction on the correlation between the endowment effect and loss aversion for risky prospects.

While we have focused on measuring the endowment effect as the ratio of WTA and WTP, it is also sometimes measured as their difference, WTA−WTP. This should also be correlated with our various measures of loss aversion. To see why, note that in all of the formulations above, WTP is decreasing in λ. WTA may be increasing in λ in classical Prospect Theory or 3PT, or unaffected by λ in KR. Thus, the gap between WTA and WTP will increase in λ under any of the above formulations.

The Correlation between WTA and WTP. In all of the formulations above, WTP is decreasing as λ increases, while WTA may be increasing (3PT) or unchanging (KR) as λ increases. Both WTA and WTP decrease as the curvature of u becomes more substantial. If, as commonly assumed, u

[12]If u exhibits CRRA, we have $a = -k\left(\frac{\eta\lambda-\eta}{1+\eta\lambda}\right)^{\frac{1}{\alpha}}$ if $\lambda \geq 1$ and $a = k\left(\frac{\eta-\eta\lambda}{1+\eta}\right)^{\frac{1}{\alpha}}$ if $\lambda < 1$.

is linear, then all variation in WTA and WTP is due to λ. This leads to a prediction of a strong negative correlation between WTA and WTP under 3PT. Under KR, the correlation is undefined, as there should be no variation in WTA other than noise—a prediction that is incompatible with our Finding 4, which documents a robust pattern of correlations between WTA and measures of risk preferences. Note that these models are thus incompatible with our data when making the common assumption of linear u.

With variation in both u and λ, then small correlations are possible only when the negative correlation induced by λ is precisely offset by the positive correlation induced by the curvature of u. This requires a specific joint distribution of these parameters, which depends on the model and functional form(s) used.

Summary. While differing in the details, the endowment effect is due to, and strictly increasing in, loss aversion λ in any of the formulations above. The same parameter also drives our measures of loss aversion for risky prospects. This allows for a parsimonious representation, but also leads to a testable prediction: the endowment effect and loss aversion for risky prospects should be substantially and positively related.

3 Design and Data

Our data come from three studies comprising three representative surveys of U.S. adults conducted online by YouGov, totaling 4,000 participants, as summarized in Table A.1.[13] All surveys were incentivized, with participants paid based on either one (Study 3) or two (Studies 1 and 2) randomly selected choices. Outcomes were expressed in points, an internal YouGov currency convertible to U.S. dollars at approximately $1 per 1,000 points.[14]

The three studies were run on independent, representative samples in 2015, 2016, and 2020. Study 1 contained 2,000 respondents, and Studies 2 and 3 contained 1,000 respondents each. Study 1 also had a second wave, which we use only to assess the level of noise in our data (Figure 1). Screenshots of the measures described below can be found in Online Appendix F.[15]

[13] As is standard in the survey research literature, our samples are constructed to be representative on observables, not on unobservables. In principle, random sampling, rather than the targeted quota sampling used by YouGov, could achieve a sample that is representative on both observable and unobservables. In practice, however, differential non-response patterns mean that other sampling methods, such as those used by YouGov, are more effective (Pew Research Center, 2016).

[14] Points can be converted into awards at specific point values, leading to a slightly convex payoff schedule. This convexity does not appear to impact participants' decision-making—see Chapman et al. (forthcoming, especially Online Appendix C.6) for a detailed discussion.

[15] More description of our data can be found in Online Appendix A. Complete design documents and screenshots can be found at eriksnowberg.com/wep.html, and will be included in replication data accompanying the paper.

Table 1: Details of Studies

	Dates	N	Avg. Time (minutes)	Avg. Pay (points)	Loss Aversion Measures
Study 1					
Wave 1	Mar. 27–Apr. 4 2015	2,000	40 (median) 55 (mean)	9,500 (median) 9,837 (mean)	DOSE-λ
Wave 2	Sep. 21–Nov. 23 2015	1,465	37 (median) 56 (mean)	9,500 (median) 10,032 (mean)	DOSE-λ
Study 2	Mar. 30–Apr. 14 2016	1,000	46 (median) 71 (mean)	13,000 (median) 13,565 (mean)	Mixed
Study 3	Feb. 21–Mar. 24 2020	1,000	43 (median) 55 (mean)	9,000 (median) 43 (mean)	DOSE-λ Mixed FM-Mixed

MPLs. Most elicitations in our surveys—including those of WTA and WTP—used multiple price lists (MPLs, Holt and Laury, 2002), a common method that is generally considered to be easier to understand than other pricing tasks (Andersen et al., 2006). MPLs are lists of binary choices between a fixed option on the left—for example, keeping an endowed lottery ticket in WTA—and a varying option on the right—for example, a number of points. The right-hand option changes monotonically. Rational participants should select options on one side until the row at which they prefer the option on the other side of the MPL. At that point, the participant should switch and continue to select the other-side option for all remaining rows.[16] The row on which a participant switches sides of the MPL identifies a range of possible values for their indifference point. We use the midpoint of this range in our analysis, but the results are similar if we use the minimum or maximum value. Participants received extensive training on MPLs, and correctly answered several comprehension questions at the beginning of each survey. In addition, Study 3 contained three "attention screeners" throughout the survey. Removing those who failed any attention screeners does not change results, see Tables 3 and C.1.

WTA and WTP. Each study contained incentivized measures of both WTA and WTP for two different lottery tickets. The order of questions was randomized, 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.

[16]The software produced an error if a participant made more than one switch. Participants were also given an "auto-complete" button to help them fill the MPL faster. In addition, there was generally a dominated choice in the top and bottom row, with the undominated option pre-selected (as suggested by Andreoni and Sprenger, 2012).

The elicitation of WTA and WTP explicitly used the language of buying and selling, in line with the literature (see, for example, Isoni, Loomes, and Sugden, 2011). For WTA, the elicitation reads:

> 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 presented with an MPL with the option "The Lottery Ticket" or "Sell it for x points," where x changed with the row.

To elicit WTP, we presented participants with the same lottery tickets as above and told them:

> 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:
>
> - 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" or "Buy the lottery ticket for (10,000−x) points and keep the remaining x points", with x varying by row. We used the same range of values of x in WTA and WTP questions to avoid biases that may come with differing ranges (Beauchamp et al., 2020; Mazar, Kőszegi, and Ariely, 2014).

Measurement Error and ORIV. We elicit two measures of most of our variables, allowing us to reduce concern that some of our results are due to measurement error and consequent attenuation bias. To do this, we take two approaches. Our main approach uses Obviously-Related Instrumental Variables (ORIV; Gillen, Snowberg, and Yariv, 2019). This adapts an errors-in-variables instrumental variables (IV) approach and produces consistent estimates of correlations. In essence, ORIV stacks all four possible IV regressions—for all possible combinations of one measure as the instrument of the other—to maximize the information in the estimate, and then applies adjustments to the regression coefficient to obtain a consistent estimate of the correlation, and to ensure that standard errors are calculated efficiently (see Gillen, Snowberg, and Yariv (2019) for details). In addition, we also average two elicitations of the same characteristic. This reduces, but does not eliminate, attenuation due to measurement error, while avoiding the increase in standard errors associated with IV methods.

Multiple Hypotheses. As two of our findings are about the limited relationship between different measures, we examine these relationships in a large number of different ways to test their robustness. This raises the concern of spurious findings. A common approach to this issue is to use corrections for multiple hypothesis testing. However, such corrections would make it *more* likely that we would establish null findings. Thus, we instead test each hypothesis independently—a more conservative approach. For similar reasons, we highlight results that are marginally statistically significant ($p < 0.1$) in our tables. Using multiple hypothesis testing adjustments would only strengthen Findings 1 and 2, while not substantially affecting Findings 3 and 4.

Measures of Risk Preferences. In addition to WTA and WTP, we collect several other measures of risk preferences.

Study 1 and 3 used Dynamically Optimized Sequential Experimentation (DOSE, Chapman et al., 2024, forthcoming) to elicit the parameters of a Prospect Theory value function with CRRA utility curvature: utility curvature (α) and loss aversion (λ). DOSE starts with a flat prior over parameters, and elicits individual-level parameter estimates by presenting participants with a personalized sequence of ten binary choices between a 50/50 lottery and a sure amount. These lotteries may contain gains only, or gains and losses. After each choice, the prior is updated, and a new question is chosen to maximize the expected information gain.

Our studies contained several other measures of risk attitudes. As with WTA and WTP, these are measured using MPLs, with two elicitations of each measure to account for measurement error. These risk measures fall into two broad categories: those eliciting certainty equivalents, and those eliciting lottery equivalents. The former group includes:

- *Gain (Studies 2 and 3)*: The certainty equivalent (sure gain) of a 50/50 lottery between a large and small (or zero) gain. For example, a 50/50 chance of 5,000 or zero points.

- *Mixed (Studies 2 and 3)*: The certainty equivalent (sure loss or sure gain) of a 50/50 lottery between a moderate gain and a moderate loss. For example, a 50/50 chance of gaining or losing 5,000 points.

- *Loss (Studies 2 and 3)*: The certainty equivalent (sure loss) of a 50/50 lottery between a large and small (or zero) loss. For example, a 50/50 chance of losing zero or 5,000 points.

- *Urn (Study 2)*: The certainty equivalent (sure gain) of a large and small (or zero) gain tied to the color of a ball drawn from an urn containing an equal number of two colors of balls. For example, an urn with 50 brown and 50 blue balls, which pays 10,000 points if a brown ball is drawn and zero if a blue ball is drawn.

The measures eliciting lottery equivalents include:

- *FM (= Fixed Money, Studies 1 and 2)*: Participants choose between a fixed monetary gain and a lottery with varying prizes but fixed probabilities. For example, we elicit the x that makes a participant indifferent between 2,500 points for sure versus a 75% chance of x points and a 25% chance of zero.

- *2L (= Two Lotteries, Studies 1 and 2)*: Participants choose between a fixed lottery and another lottery in which one prize varies. For example, we elicit the x that makes a participant indifferent between a 25% chance of 2,500 points and a 75% chance of zero versus a 20% chance of x points and an 80% chance of zero.

- *FM–Mixed (Study 3)*: This elicitation is similar to FM above, but the fixed amount is zero and the varying lottery includes an equal chance of a fixed gain and a varying loss y. For example, we elicit the y that makes a participant indifferent between a lottery over a loss of y and a gain of 5,000 points and a sure amount of 0 points.

Loss Aversion for Risky Prospects. We derive three measures of loss aversion for risky prospects from the variables above, drawing on different methodological approaches, as summarized in Table A.1. First, in Studies 1 and 3, we have the parameter λ estimated by the DOSE procedure. In some of our specifications, we also control for the CRRA risk aversion parameter α estimated by the same procedure. We refer to these measures as *DOSE-*λ and *DOSE-*α. Second, in Studies 2 and 3, we have *Mixed*, the certainty equivalent of a lottery of equal gains and losses. Third, in Study 3, we also have *FM-Mixed*, the lottery equivalent of 0, in which there is a fixed gain and a variable loss. The latter two are widely used continuous measures of loss aversion. In some of our specifications, we control for curvature using Gain and Loss, described above. In what follows, all measures are normalized such that higher values denote higher loss aversion.

Other measures. Our surveys also contain a cognitive ability measure and several demographic characteristics that are used in subgroup analysis. The cognitive ability measure is a six-question battery from the International Cognitive Ability Resource (ICAR; Condon and Revelle 2014) that gives a measure of IQ. In addition, each study contains some other measures and elicitations not used in this paper. Depending on the study, these measures include, for example, social and time preferences, ethnicity and race, political behaviors, and so on.[17]

Student Samples. We also implemented two additional surveys using student samples recruited from the University of Pittsburgh Experimental Laboratory (PEEL) mailing list. These studies were also administered by YouGov. The first student sample (N = 369) participated in a study similar

[17]More description of our data can be found in Online Appendix A. For the complete design documents of each of these studies, see eriksnowberg.com/wep.html. Screenshots of the specific questions used in this study are included in Appendix F.

to Study 1 in January 2019; the second student sample (N = 437) participated in a study similar to Study 3 in November 2021. These studies are primarily used in Section 6.[18]

4 Findings

We begin by analyzing the basic patterns of WTA, WTP, the endowment effect, and loss aversion in our surveys, and then establish the three main findings described in the Introduction.

WTA, WTP, and the Endowment Effect. We find robust evidence of an endowment effect across the U.S. population, both in aggregate and at the individual level. Across all studies and lotteries, WTA was 90% of the expected value of the lottery ticket, while WTP was 68%, giving us an aggregate endowment effect—see Appendix Table A.1 for a breakdown by lottery and study. Further, as we measure both WTA and WTP for each participant, we can estimate the endowment effect at an individual level. Across our three representative studies, 58% of participants demonstrate a (strictly positive) endowment effect, with another 12% who have WTA=WTP. The remaining 30% express a negative endowment effect. These proportions are relatively constant across all the subgroups we examine, including our sample of students from the University of Pittsburgh, see Appendix Tables D.3 and D.4. Moreover, the proportion exhibiting a negative endowment effect is similar to the 29% of participants with a negative endowment effect across all five prior (lab) studies we have found that use a within-participant design to study WTA and WTP for lotteries, as discussed in Section 4.3.

Our data provide what may be the largest, and most robust, evidence for a pervasive individual-level endowment effect in the general population. For the analysis below, we construct two individual-level measures of the endowment effect: the ratio of WTA to WTP (mean=2.07, median=1.18, s.d.=2.08), and the difference between WTA and WTP (mean=22% of the expected value of the lottery, median=13%, s.d.=51%). The magnitude of the endowment effect that we find is similar to that reported by Isoni, Loomes, and Sugden (2011): across the five lotteries in that study, the mean WTA/WTP ranged from 1.11 to 2.19, and the median from 1 to 1.33.

Measures of Loss Aversion for Risky Prospects. We have three measures of loss aversion for risky prospects: DOSE-λ in Studies 1 and 3, Mixed in Studies 2 and 3, and FM-Mixed in Study 3. Approximately half of participants are classified as loss averse under each of these measures (47% by DOSE-λ, 47% by Mixed, and 51% by FM-Mixed).[19] Despite the very different methodologies,

[18]The students completed the survey online, and questions were presented with the same point values as in our representative samples. The most significant difference was that students received the value of their points converted into cash within two weeks, via Visa gift card, rather than deposited into a YouGov account. For the complete design documents of each of these studies, see eriksnowberg.com/wep.html.

[19]For FM-Mixed and Mixed, we classify participants as loss averse by averaging across the two elicitations of each measure. Over the four elicitations, the proportion of choices consistent with either loss neutrality or loss aversion

our three loss aversion measures correlate with each other. Two of our measures—DOSE-λ and FM-Mixed—are highly correlated (ORIV Correlation 0.49, s.e.=0.04). The third—Mixed—is also significantly correlated with the other two, albeit somewhat less substantially (ORIV Correlation with DOSE-λ 0.20, s.e. 0.05; ORIV Correlation with FM-Mixed 0.13 (s.e.=0.06).[20]

Measurement Error. We assess the level of measurement error in our studies in two ways, as displayed in the two panels of Figure 1. First, in the left-hand panel, we observe high correlations between the two elicitations of each of our survey measures, clearly demonstrating that the variables are not simply capturing noise. The correlations between different elicitations range between 0.64 and 0.83, comparable to the 0.75 that Snowberg and Yariv (2021) found among Caltech undergraduate students—a population where we would anticipate low levels of measurement error—completing a question similar to Urn.

The over-time correlations in our studies are also similar to those found among Caltech students, as shown in the right-hand panel of Figure 1. This figure estimates the over-time stability of measures of risk preferences and loss aversion for risky prospects measured six months apart in Study 1, and also shows similar estimates from (Gillen, Snowberg, and Yariv, 2019) among Caltech undergraduates. Our measures are relatively stable within individuals over time, with correlations across survey waves ranging from 0.33 to 0.44—similar to the over-time correlation of 0.41 in Caltech undergraduates. Overall, these results suggest that our measures capture relatively stable behavioral traits.

4.1 Finding 1: The Endowment Effect is Not Correlated with Loss Aversion for Risky Prospects

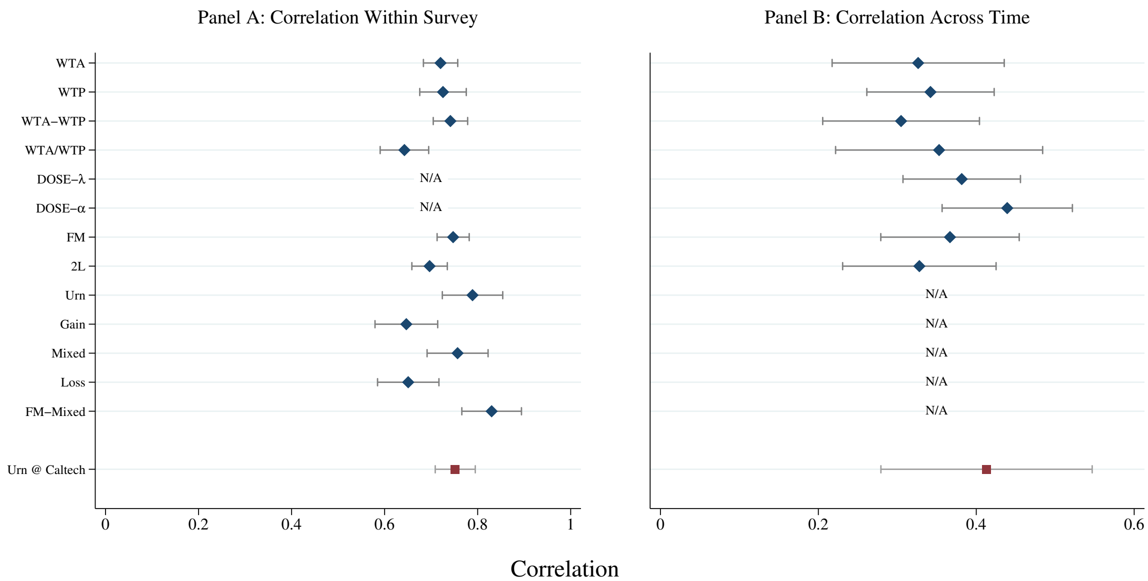
The main prediction of the models discussed in Section 2 is that the endowment effect should be positively correlated with loss aversion for risky prospects.

This prediction is not supported in our data, for either measure of the endowment effect, nor for any of the three measures of loss aversion in our study, whether or not one controls for risk aversion (utility curvature), as shown in Table 2. The columns of Table 2 vary the measure of the endowment effect and the specification, while each panel uses a different measure of loss aversion. All coefficients on loss aversion are small and not significantly different from zero, except the relationship

is 63%. See Chapman et al. (forthcoming) for a detailed discussion of heterogeneity in our loss aversion measures, including a wide range of robustness tests and comparisons with previous literature. Our measures of risk aversion classify most participants as risk neutral or risk averse over gains (76% by DOSE-α, 55% by Gain, 70% by FM, and 73% by 2L), and risk-neutral or risk-loving over losses (72% by Loss).

[20]As we discuss in Section 4.4, the less substantial correlation between Mixed and FM-Mixed is likely explained by the structure of these two questions.

Figure 1: Relatively Low Measurement Error in Our Surveys



Notes: The left-hand panel displays correlations between the two different elicitations of each variable across all of our surveys. The right-hand panel displays correlations between the measures collected across the two waves of Study 1, which were conducted six months apart. "Urn @ Caltech" relates to two elicitations of a measure similar to Urn, collected from Caltech undergraduates by Gillen, Snowberg, and Yariv (2019; $N = 903$ for within study correlation, $N = 785$ for over-time correlation). Over-time correlations are estimated using ORIV, except for the DOSE-elicited parameters, for which there is only a single measure in each survey wave.

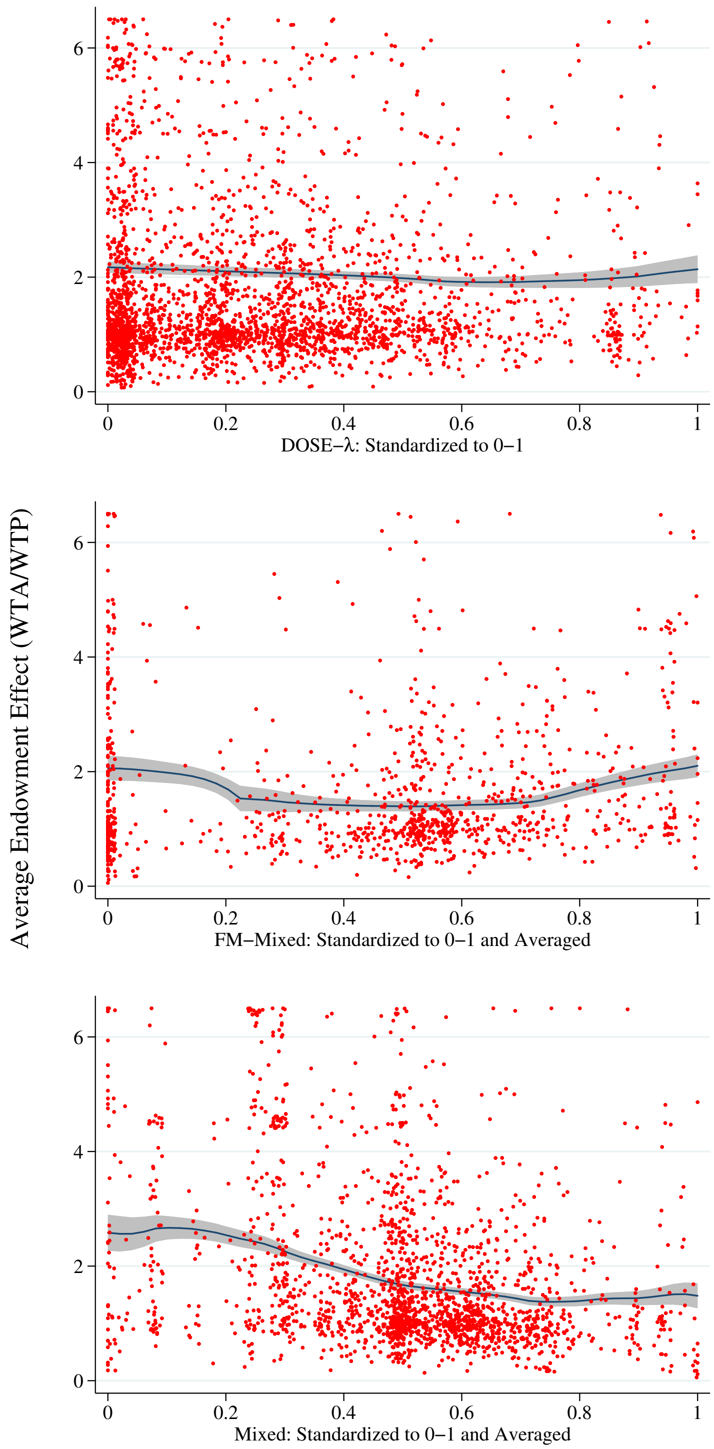
between Mixed and the endowment effect, which has the *opposite* of the predicted sign.[21]

These statistical results are confirmed visually in Figure 2. This figure shows a scatter plot of the endowment effect (measured as the ratio of WTA to WTP) versus DOSE-λ in Panel A, versus FM-Mixed in Panel B, and versus Mixed in Panel C. Each panel also includes a non-parametric fit of the data. As in Table 2, the only obvious correlation is the negative one between the endowment effect and Mixed, in Panel C.

The theories considered in Section 2, like KR and 3PT, make additional predictions regarding the relationship between loss aversion for risky prospects and the constituent components of the endowment effect—WTA and WTP—which we can also examine with the data. For WTA, the only statistically-significant relationship is a correlation of -0.28 (s.e.= 0.050, $p < 0.01$) with Mixed. Neither of the theories we consider predicts a negative relationship between WTA and loss aversion. WTP is correlated 0.05 with DOSE-λ (s.e. = 0.025, $p = 0.03$), -0.18 (s.e. = 0.060, $p < 0.01$) with FM-Mixed, and 0.18 (s.e. = 0.044, $p < 0.01$) with Mixed. All models predict the negative

[21]We disaggregate Table 2 by study and lottery in Appendix Table B.1, and in no specification is there a positive and statistically-significant relationship between any of our measures of loss aversion and either measure of the endowment effect. Naturally, adjusting p-values for multiple hypothesis testing would only reduce the statistical significance of these correlations.

Figure 2: No Evidence of a Positive Correlation between Loss Aversion and the Endowment Effect



Notes: Scatter plot is shown with a small amount of jitter. Horizontal axis standardizes loss aversion measure between 0 and 1. In the second and third panel, this is done before averaging.

Table 2: Relationships between the endowment effect and loss and risk aversion

Dependent Variable:	WTA/WTP		WTA–WTP	
Panel A: DOSE (Study 1 & 3; N = 3,000)				
Loss Aversion (λ)	−0.03	−0.03	0.02	0.02
	(.03)	(.029)	(.029)	(.027)
Risk Aversion ($1-\alpha$)		−0.07**		−0.12***
		(.034)		(.032)
Panel B: FM-Mixed (Study 3; N = 1,000; ORIV)				
Loss Aversion	−0.07	−0.07	0.07	0.07
(FM-Mixed)	(.075)	(.072)	(.068)	(.062)
Risk Aversion		−0.27***		−0.32***
(Gains)		(.098)		(.096)
Risk Aversion		−0.20***		−0.24***
(Losses)		(.071)		(.083)
Panel C: Mixed (Study 2 & 3; N = 2,000; ORIV)				
Loss Aversion	−0.40***	−0.21***	−0.38***	−0.12*
(Mixed)	(.047)	(.07)	(.047)	(.067)
Risk Aversion		−0.27***		−0.32***
(Gains)		(.07)		(.07)
Risk Aversion		−0.08		−0.18***
(Losses)		(.064)		(.065)

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

relationship with WTP we find for the FM-Mixed measure, but not the positive relationship with the DOSE-λ or Mixed measures. As we discuss in Section 4.4, this overall pattern is better explained by the hypothesis that these correlations are driven by the structure of the question, rather than by a unified notion of loss aversion.

Subgroups. Examining the results in Table 2 among different subgroups shows that they seem to hold fairly generally across the population, and are not simply due to groups of noisy respondents.

In principle, it is possible that noisy data from specific groups of participants—such as those who fail attention-screener questions—could wash out a positive correlation among the remaining ones.[22] This is not the case in our data, as shown in Table 3, which presents the six specifications

[22] As we use ORIV—which corrects for idiosyncratic measurement error—for the specifications involving Mixed or FM-Mixed, a particular subgroup obscuring a correlation between the endowment effect and loss aversion in the general

from Table 2 that control for risk aversion for several subgroups. Appendix Table B.3 replicates this analysis without controlling for risk aversion; results are substantially similar.

Results are similar when we eliminate participants who may be paying less attention. The second and third rows eliminate participants who failed an attention screener in Study 3, and the participants who completed the survey in the fastest 10% of times, respectively.[23]

The remaining rows examine demographic subgroups that may exhibit different response characteristics. Once again, results are not substantially different than those in the entire sample, with two notable exceptions. First, for two subgroups—above median incomes, and those who attended college—one out of six of the specifications produces marginally statistically significant results (recall, however, that we do not adjust for testing multiple hypotheses). However, two out of six specifications for those with incomes in the top 5% of our sample have negative and statistically significant correlations. Second, participants in the top 5–10% of our IQ measure exhibit stronger positive correlations. Indeed, the strongest positive relationship in Table 3 is for those in the top 5% of IQ, using FM-Mixed as the measure of loss aversion for risky prospects, and the difference between WTA and WTP as the measure of the endowment effect. Some positive results, albeit not even marginally significant, are present for IQ in the top 10%. Correlations for those with IQ above the median are much closer to the results for the full sample.

We also stratify participants by other subgroups in Appendix Table B.2. Across those additional subgroups, the largest positive correlation is for those with above median Cognitive Reflection Test (CRT; Frederick, 2005) scores, using FM-Mixed as the measure of loss aversion for risky prospects, and the difference between WTA and WTP as the measure of the endowment effect. However, that coefficient falls and is insignificant when considering those with a CRT score in the top 10%. Across all subgroups and specifications we consider here and in the appendix, only 6 out of 150 have positive and statistically-significant coefficients at the $p < 0.1$ level, without adjusting for multiple hypothesis testing. By contrast, 20 out of 150 have a negative and significant correlation.[24] These are primarily in specifications involving Mixed as the measure of loss aversion for risky prospects. As mentioned above, we believe this is driven by the structure of the questions, which we discuss in Section 4.4.

Overall, our analysis indicates a lack of correlation between loss aversion for risky prospects and the endowment effect, with the possible exception of a positive correlation among high-IQ

population would require non-classical measurement error, such as a response bias. Further, YouGov automatically excludes from the final dataset participants who do not appear to take the survey seriously—completing the survey overly fast, or choosing the same option in many questions.

[23]The percent of participants in Study 3 who failed at least one attention screener (16%) compares favorably to 18% of students from the University of British Columbia who failed at least one attention screener in a laboratory environment, see Snowberg and Yariv (2021).

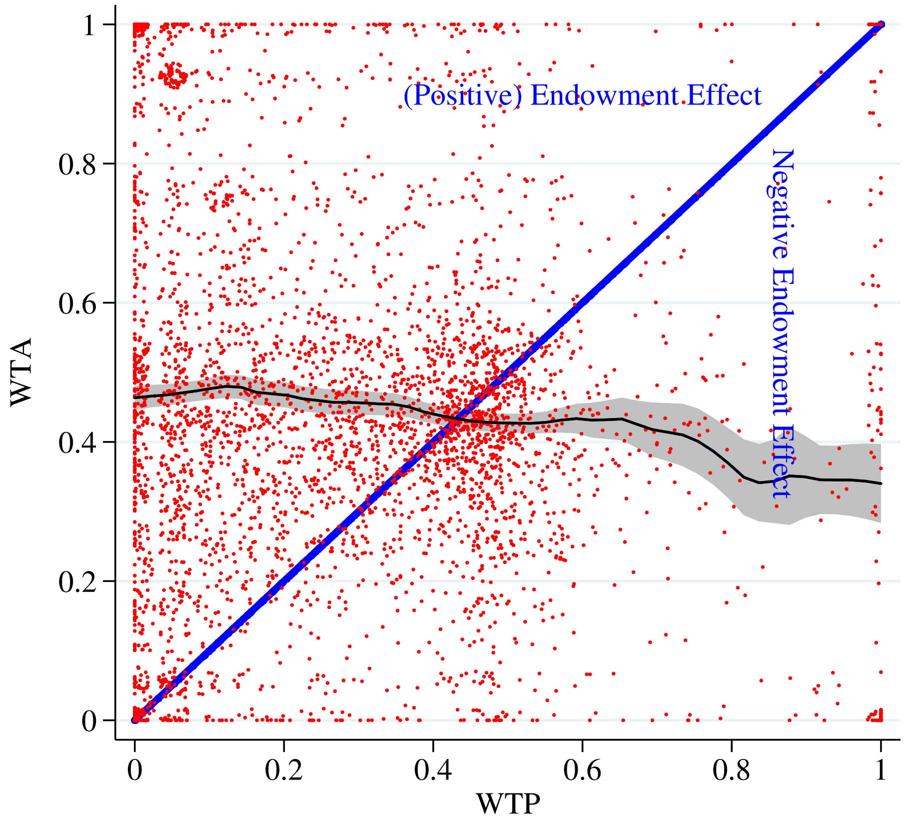
[24]Adjustments for multiple hypothesis testing would be complicated by the fact that the subgroups and specifications are not independent.

Table 3: Relationship between the endowment effect and loss aversion, controlling for risk aversion, by subgroup

Loss Aversion:	DOSE		FM-Mixed		Mixed	
Endowment Effect:	WTA/WTP	WTA–WTP	WTA/WTP	WTA–WTP	WTA/WTP	WTA–WTP
Estimation:	Regression		ORIV		ORIV	
All	−0.03	0.02	−0.07	0.07	−0.21***	−0.12*
	(.029)	(.027)	(.072)	(.062)	(.07)	(.067)
	N = 3,000		N = 1,000		N = 2,000	
Passed Attention Checks	−0.01	0.07	−0.04	0.06	−0.00	0.10
	(.059)	(.056)	(.077)	(.064)	(.109)	(.105)
	N = 840 †		N = 840 †		N = 840 †	
Not Too Fast	−0.03	0.02	−0.02	0.10	−0.22***	−0.11
	(.03)	(.028)	(.075)	(.066)	(.074)	(.073)
	N = 2,701		N = 900		N = 1,801	
High School or Less	0.01	0.07	−0.13	0.03	−0.15	−0.01
	(.052)	(.048)	(.151)	(.13)	(.143)	(.137)
	N = 1,199		N = 345		N = 757	
Some College or College Degree	−0.03	0.01	−0.01	0.10*	−0.24***	−0.17**
	(.037)	(.033)	(.062)	(.058)	(.078)	(.077)
	N = 1,495		N = 534		N = 1,035	
Advanced Degree	−0.09*	−0.05	0.02	0.10	−0.16	−0.17
	(.053)	(.072)	(.088)	(.092)	(.132)	(.134)
	N = 306		N = 121		N = 208	
Income: Above Median	0.02	0.05	0.02	0.11*	−0.19**	−0.10
	(.043)	(.038)	(.078)	(.063)	(.078)	(.073)
	N = 1,417		N = 509		N = 972	
Income: Top ∼ 10%	−0.07	−0.05	−0.07	0.01	−0.37**	−0.26
	(.055)	(.06)	(.092)	(.098)	(.172)	(.18)
	N = 381		N = 161		N = 263	
Income: Top ∼ 5%	−0.04	−0.08	−0.34**	−0.26**	−0.15	−0.15
	(.104)	(.108)	(.162)	(.126)	(.155)	(.155)
	N = 137		N = 58		N = 102	
IQ: Above Median	0.02	0.05	0.01	0.09	−0.15	−0.08
	(.037)	(.037)	(.066)	(.058)	(.091)	(.097)
	N = 1,713		N = 629		N = 1,182	
IQ: Top ∼ 10%	0.12	0.13	−0.03	0.14	−0.03	0.06
	(.12)	(.089)	(.127)	(.149)	(.162)	(.188)
	N = 337		N = 122		N = 209	
IQ: Top ∼ 5%	−0.07	−0.01	0.11	0.21**	0.23	0.18
	(.05)	(.061)	(.082)	(.108)	(.282)	(.318)
	N = 114		N = 47		N = 88	

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, unadjusted for multiple hypotheses, with standard errors in parentheses. Number of observations for each cell are given below standard errors, and differ across columns, as each measure of loss aversion for risky prospects appears in different studies. †: Number of observations are the same, as attention checks were only present in Study 3.

Figure 3: WTA and WTP are largely unrelated.



Notes: Axes represent the average WTA and WTP for two lotteries. WTA and WTP for each lottery are measured as the percent of the expected value, normalized to [0,1], and are displayed with a small amount of jitter.

subsamples. We discuss this further when describing the previous literature in Section 6.

4.2 Finding 2: WTA and WTP are Not Positively Correlated

We have demonstrated that the endowment effect is unrelated to loss aversion for risky prospects, in contrast to the leading explanation in economics. We now turn to our additional findings about WTA and WTP that can be used to further refine theories of the endowment effect.

In our data, WTA and WTP are, at best, very weakly related to each other: observing a high willingness to pay for a lottery ticket conveys very little information about willingness to accept. This is shown graphically in Figure 3, which plots the average WTA against the average WTP for all 4,000 participants in our data. There is wide variation in both WTA and WTP, and a non-parametric fit of the data demonstrates that while there is a negative relationship throughout, this is strongest for those who express risk-loving preferences for the lottery ticket (WTP $>$ 0.5 on the normalized scale of the figure). The slope in this region of the graph is not well estimated, as it contains only

Table 4: Correlations between WTA and WTP

	N	Lottery 1	Lottery 2	ORIV	Averages
Study 1	2,000	-0.06^{*} (.037)	-0.06^{*} (.037)	-0.09^{**} (.043)	-0.08^{**} (.037)
Study 2	1,000	-0.09^{*} (.051)	−0.06 (.056)	−0.11 (.069)	−0.09 (.058)
Study 3	1,000	-0.13^{**} (.058)	-0.12^{**} (.052)	-0.15^{**} (.067)	-0.13^{**} (.055)
All Studies	4,000	-0.08^{***} (.027)	-0.08^{***} (.027)	-0.11^{***} (.033)	-0.09^{***} (.027)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, uncorrected for multiple hypothesis testing. Note that as Wave 2 of Study 1 contains a subset of individuals from Wave 1, we do not include it in the "All Studies" row.

14% of the participants.[25]

The visual patterns in Figure 3 are confirmed by statistical analysis in Table 4. In all of our studies, the relationship between WTA and WTP is small in magnitude and typically negative. The last two columns take steps to reduce concerns that this is due to measurement error by using ORIV and by averaging across the two lotteries. Doing so does not affect our results.

The finding that WTA and WTP are, at best, weakly correlated is incompatible with the models discussed in Section 2 under the very common assumption that u is linear. Recall that, under that assumption, all variation in WTA and WTP is due to variation in λ, with WTP decreasing when λ increases, while WTA may be increasing (3PT) or unchanging (KR) when λ increases. Under 3PT, this leads to a strong negative correlation between WTA and WTP, contrary to what we document. Under KR, the correlation is undefined, but there should be no variation in WTA other than noise—which is not the case in our data, as our measures of WTA are related to each other.

Subgroups. In Appendix Table C.1, we examine the correlation between WTA and WTP within the different subgroups analyzed in Table 3. Correlations are small in magnitude in most of the subgroups we examine. As was the case for Finding 1, we see a different result among those with the Top 5% of IQs, as measured in our survey: in this group the ORIV correlation is 0.32 and statistically significant. Interestingly, this is similar to the correlation expected by our expert panel, of whom 63% expected the correlation to be greater than 0.25, with an average predicted correlation of 0.35. This suggests that the experts may be calibrated to high-IQ groups, such as the undergraduate

[25] Similar patterns are found for each lottery ticket in each study when analyzed separately, see Appendix Figure C.1.

students found in laboratory samples (Snowberg and Yariv, 2021).

We also observe a small positive correlation between WTA and WTP in a reanalysis of the data from five laboratory studies ($N = 790$) that use within-participant designs to study the WTA and WTP for lotteries.[26] Across these five studies—detailed in Appendix Table A.3—the average correlation between WTA and WTP is 0.12, and the correlation is positive in six out of seven experimental groups. This pattern of positive correlations may reflect the fact that these studies use student samples, which are likely more similar to high-IQ subgroups than to the population as a whole. Consistent with this explanation, we observe a similar magnitude correlation—0.11 (s.e.=.02)—within our student sample.

Taken together, the evidence across our studies is that the correlation between WTA and WTP is small in magnitude, except for in high-IQ subgroups.

4.3 Finding 3: A Consistent ~30% of Participants Exhibit WTA Below WTP

A substantial minority—around 30%—of our participants exhibit a negative endowment effect (that is, WTP > WTA), as shown in Figure 4.[27] The within-person stability of the endowment effect, also shown in Figure 4, suggests the presence of a negative endowment effect is not just noise. While a substantial minority exhibiting a negative endowment effect was somewhat expected by our expert panel—on average, they projected that 41% would not exhibit an endowment effect (13% negative, 28% zero)—it has not, to our knowledge, been discussed or reported in prior studies. Reanalyzing data from those studies with available data, 29% of participants, on average, exhibit a negative endowment effect.

The within-person stability of the negative endowment effect is much higher than one would expect if this finding were simply due to noise. In particular, of those who exhibit a negative endowment effect in pricing the first lottery, 65% (s.e.=2.2%) exhibit a negative endowment effect when pricing a second lottery.[28] If the negative endowment effect arose by chance, then we would expect only around 30% of those who exhibited a negative endowment effect for one lottery to exhibit it for the other. Yet, the proportion is much, much higher. This allows us to easily reject a null that the negative endowment effect arises as an artifact of random noise. Moreover, this rate is similar to those who exhibit a strictly positive endowment effect for the first lottery: 71% (1.8%) of those participants exhibit a strictly positive endowment effect in the second lottery.

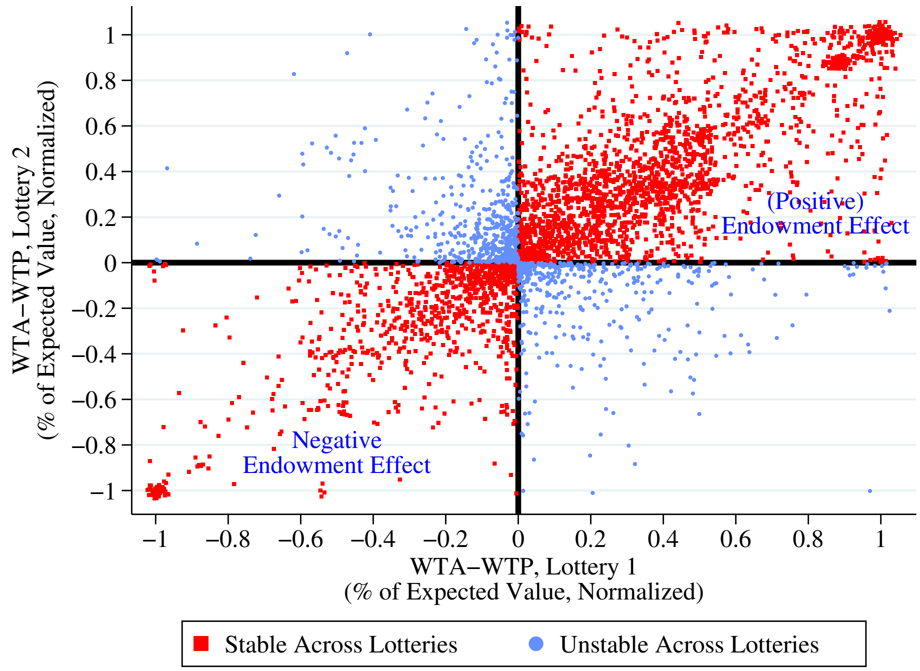
The proportion of participants expressing a negative endowment effect in our representative

[26] See Appendix A.4 for a discussion of how we located these studies, and more details of each study.

[27] Conditional on being negative, the mean endowment effect was 41% of Expected Value for Lottery 1 and 29% for Lottery 2. In comparison, conditional on being positive, the mean endowment effect was 67% for Lottery 1 and 45% for Lottery 2.

[28] This percentage was estimated by combining all our datasets, excluding participants making dominated choices in any of the lotteries, and averaging across the two lotteries in our study.

Figure 4: The endowment effect is negative for a substantial minority of participants.



Notes: The axes represent the endowment effect for each lottery, calculated as $WTA - WTP$, each measured as the percent of the expected value and normalized to [0,1]. Points are displayed with a small amount of jitter. "Stable across lotteries" indicates that the sign of the endowment effect was the same in both lotteries (that is, was either positive or negative in both lotteries), and "Unstable across lotteries" indicates that the sign varied across the two lotteries.

sample is similar to the proportions in both our student sample and in five prior laboratory studies with available data—see Appendix A.4, and especially Appendix Table A.3. On average, 29% of participants in these studies exhibited an negative endowment effect—identical to the 29% we find across our studies. This is despite the fact that these studies employ different participant pools, lotteries, and techniques for measuring the endowment effect.[29] Moreover, this rate is similar to our student sample, in which 33% of participants exhibit a negative endowment effect, suggesting that this finding is not an artifact of our online survey implementation. Finally, the rate of participants expressing a negative endowment effect is quite stable across every subgroup we have examined within our data; see Appendix Tables D.3 and D.4. In particular, this includes subgroups that exclude participants most likely to be inattentive, providing further evidence that this finding is not an artifact of our participant pool or study environment.

[29]Four of the studies—Kachelmeier and Shehata (1992); Isoni, Loomes, and Sugden (2011); Fehr, Hakimov, and Kübler (2015); and Vosgerau and Peer (2018)—use the BDM mechanism (Becker, DeGroot, and Marschak, 1964) to elicit WTA and WTP, and Loomes, Starmer, and Sugden (2003) uses a median price auction.

4.4 Finding 4: WTA and WTP Relate to Different Clusters of Risk Preferences

Our data show two clear clusters of risk preferences, with strong correlation within clusters, and weak correlation across. WTA and WTP fall into different clusters, consistent with the lack of correlation between the measures discussed in Finding 2. In particular, WTA is strongly related to certainty equivalents of lotteries, whereas WTP is strongly related to lottery equivalents of sure amounts. This pattern suggests that risk attitudes depend on whether one is—implicitly or explicitly—buying or selling a lottery, and further reinforces the idea, based on Finding 2, that WTA and WTP may be determined by distinct processes.

As shown in Table 5, WTA and WTP are related to different risk preference measures. This table shows the correlations between WTA, WTP, and the risk preferences measures in Study 2.[30] A very clear pattern emerges: there are two clusters of strongly-related variables. The first cluster includes WTA and the certainty equivalent measures: Urn, Gain, Mixed, and Loss. The second cluster includes WTP and the lottery equivalents: FM and 2L.[31] These clusters feature large within-cluster correlations and smaller correlations with measures in the other cluster.[32] A principal components analysis confirms these clusters, and suggests relationships with a broad range of other preference measures: this is studied in detail in Chapman et al. (2023).

A possible explanation for these findings, suggested by Hershey and Schoemaker (1985) and Sprenger (2015), is that certainty equivalent measures involve implicitly selling a lottery, and lottery equivalent measures involve implicitly buying a lottery. That is, these papers suggest that MPL-based risk elicitations induce reference effects with the fixed option of the MPL treated as an endowment. In our certainty equivalent 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, participants are asked how much money they will accept for the lottery. In this light, it is not surprising that these measures are related to WTA, which is explicitly framed as selling. 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—it is thus related to our measure of WTP, which is explicitly framed as buying.[33]

[30] Correlations are calculated using ORIV. All risk aversion measures 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. The correlations in this table are arranged to highlight the clusters, rather than displayed as a traditional lower-diagonal matrix.

[31] Study 3 contains a subset of these measures, and the pattern of correlations among them is largely consistent with Table 5.

[32] The fact that theoretically-equivalent measures of risk attitudes are weakly correlated is consistent with a large literature. For recent reviews in economics and psychology, see Friedman et al. (2014); Pedroni et al. (2017); Holzmeister and Stefan (2021). Gillen, Snowberg, and Yariv (2019) suggest that findings of low correlations between measures of risk attitudes may be due to measurement error—we adopt their techniques to rule this out.

[33] It is worth noting that our measure of WTP is an MPL with a fixed lottery, thus implicitly framed as a WTA measure. This suggests that the explicit framing of buying dominates the implicit effect of the question structure.

Table 5: ORIV Correlations between WTA, WTP, and Other Risk Measures, Study 2.

				Certainty Equivalent				Lottery Equivalent
		WTA	Urn	Gain	Mixed	Loss	WTP	FM
Certainty Equivalent	Urn	-0.66^{***}					0.07	
		(.051)					(.067)	
	Gain	-0.66^{***}	0.65^{***}				0.04	
		(.064)	(.058)				(.071)	
	Mixed	-0.58^{***}	0.51^{***}	0.60^{***}			0.19^{***}	
		(.063)	(.058)	(.057)			(.071)	
	Loss	-0.27^{***}	0.26^{***}	0.39^{***}	0.65^{***}		0.30^{***}	
		(.076)	(.066)	(.07)	(.067)		(.088)	
Lottery Equivalent	FM	−0.03	0.05	0.09	-0.14^{*}	-0.19^{**}	-0.45^{***}	
		(.07)	(.066)	(.069)	(.07)	(.075)	(.048)	
	2L	0.12^{*}	-0.17^{***}	-0.13^{*}	-0.21^{***}	-0.15^{*}	-0.28^{***}	0.41^{***}
		(.072)	(.066)	(.072)	(.073)	(.077)	(.061)	(.062)

Notes: ***, **, * denote statistical significance at the 1%, 5%, and 10% level, unadjusted for multiple hypothesis testing. Each cell in the table is an ORIV correlation with standard errors in parentheses. All measures except WTA and WTP are (re)coded so that higher values correspond to greater risk aversion.

With this interpretation, Table 5 further supports Finding 2—that WTA and WTP are unrelated—and also suggests a novel way of eliciting individual-level endowment effects. In Table 5, measures of WTA and WTP are largely unrelated, regardless of whether the framing is implicit or explicit. The correlation between Urn (or Gain) and FM is statistically indistinguishable from zero. This is also true of the correlations between the explicitly-framed WTA measure and the implicitly-framed WTP measure (FM), and between the explicitly-framed WTP measure and the two implicitly-framed WTA measures (Urn and Gain). Further, these framing effects suggest that certainty equivalents can be used as measures of WTA, and lottery equivalents can be used as measures of WTP—and thus that the endowment effect can be measured as the difference between certainty and lottery equivalents. This suggestion is supported by our data: the ORIV correlation between the WTA minus WTP and Urn minus FM is 0.54. Eliciting the endowment effect in this way may be useful in contexts where endowing individuals with an object is difficult.

Similar framing effects could also provide an explanation for the pattern of correlations we see between our various measures of loss aversion and WTA and WTP, mentioned in Section 4.1. Under this interpretation, the negative relationship between WTA and Mixed, which is not predicted by the theories in Section 2, occurs because the latter is a certainty equivalent measure, and hence implicitly involves selling. Similarly, the negative relationship between WTP and FM-Mixed is consistent with the latter being a lottery equivalent measure, and hence implicitly involving buying. Further, WTP is less correlated with FM-Mixed than it is with the lottery equivalent measures containing only positive payoffs. If loss aversion were driving both WTP and the increase in risk aversion for lotteries including both gains and losses, we would expect a stronger relationship between WTP and FM-Mixed than between WTP and FM or 2L, as neither of the latter two include losses. The observed opposite pattern is, once again, inconsistent with loss aversion driving both WTP and the increase in risk aversion for lotteries that include both gains and losses.

Response times provide further evidence that participants behave differently depending on whether they are buying or selling a lottery, consistent with emerging evidence in neuroscience that different neural processes govern the two activities. The two WTA questions had much shorter response times (88 seconds on average) than the two WTP questions (122 seconds).[34] This difference is large: WTP has the longest median response time of the eight sets of risk aversion questions, while the two Gain questions had the shortest (74 seconds). This evidence is consistent with findings of different patterns of brain activity when buying versus selling (Hu et al., 2014; Krajbich, Oud, and Fehr, 2014). De Martino et al. (2009), for instance, find that the WTP is processed by the medial orbitofrontal cortex (mOFC), while WTA is processed by a more lateral portion of the

[34]We report medians to avoid skew from very long responses. The 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. 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.

OFC (the lOFC).[35]

5 Alternative Theories

As our results rule out models that attribute the endowment effect to loss aversion, we now discuss if and how alternative theories can explain our findings. The literature in economics and psychology has introduced a vast array of models of the endowment effect. Most, however, do not study loss aversion for risky prospects, and so are silent about the main result of this paper, Finding 1. Models in this class include Reference Prices (Weaver and Frederick, 2012; Isoni, Loomes, and Sugden, 2011), Strategic Pricing (Smitizsky, Liu, and Gneezy, 2021), Incomplete Preferences (Bewley, 1986; Masatlioglu and Ok, 2005, 2014; Ortoleva, 2010), Imprecise Preferences (Dubourg, Jones-Lee, and Loomes, 1994; Butler and Loomes, 2007; Cubitt, Navarro-Martinez, and Starmer, 2015), Differential Focus, Information Processing, or Query Theory (Carmon and Ariely, 2000; Nayakankuppam and Mishra, 2005; Johnson, Häubl, and Keinan, 2007; Ashby, Dickert, and Glöckner, 2012; Pachur and Scheibehenne, 2012)—see Morewedge and Giblin 2015 for a review.

In addition to the models explored in Section 2—and contradicted by our Finding 1—we have identified two theoretical frameworks that make predictions both for the endowment effect and loss aversion for risky choice: Cautious Utility and Salience. As we describe in detail below, Cautious Utility (Cerreia-Vioglio, Dillenberger, and Ortoleva, forthcoming) is potentially compatible with all of our findings, under specific distributional assumptions. Salience (Bordalo, Gennaioli, and Shleifer, 2012a,b, 2022) does not appear compatible with our results.

5.1 Cautious Utility

In Cautious Utility, individuals may be unsure of the precise value to assign to a good, and apply a criterion of *caution*, adopting the lowest monetary value among those they consider. For example, consider an individual who is unsure whether they value an object of \$1 or \$2. When selling, caution induces the individual to ask for at least \$2, as they are worried about foregoing something valuable. In contrast, when buying, the individual is unwilling to pay more than \$1, as caution induces them to worry about overpaying. This uncertainty about valuations can generate both the endowment effect and loss aversion for risky prospects, independently.

Formally, individuals evaluate outcomes relative to a (possibly stochastic) reference point, like in Prospect Theory.[36] Uncertainty about valuations is captured by assuming they consider not one

[35]See also Knutson et al. (2008), which finds distinct activity in the medial prefrontal cortex (mPFC) when making a buying decision at a low price and (more weakly) a selling decision at a high price, and Tong et al. (2016), which finds overlapping neural activity when participants process high prices during selling and low prices during buying.

[36]That is, they evaluate outcome x given reference point r using $(x - r)$, where both x and r could be vectors of allocations.

but a *set* of utility functions $\mathcal{W}$. Caution is captured by assuming they evaluate each outcome using the most conservative utility in the set, using the function $V(x) = \inf_{v \in \mathcal{W}} \text{ce}_v(v(x))$, in which $\text{ce}_v(\cdot)$ denotes the monetary certainty equivalent using utility v.

It is easy to see how this can generate the endowment effect, even without any asymmetry in the treatment of gains and losses. For example, the individual above, who is unsure whether the monetary value of an object is \$1 or \$2, can be formalized as having two utilities over money (x_m) and objects (x_0): $u_1(x_m, x_o) = x_m + x_0$ and $u_2(x_m, x_o) = x_m + 2x_0$. Both utilities are linear, and have no asymmetry for gains and losses. Yet, this individual exhibits an endowment effect. To see why, notice that for u_1, the WTP and the WTA are \$1, while they are \$2 for u_2. Caution makes it so that the individual picks the lowest value for the WTP and the highest value for the WTA (Cerreia-Vioglio, Dillenberger, and Ortoleva, forthcoming, Proposition 1), giving WTA = 2 > 1 = WTP, that is, the endowment effect.[37]

Cautious Utility also explicitly studies risk preferences, and has been extended to the endowment effect for lotteries over money, following the same intuition, but adopting a stochastic reference point. In this case, the endowment effect is generated by uncertainty over the exact curvature of the utility for gains and losses (see Cerreia-Vioglio, Dillenberger, and Ortoleva, forthcoming, Section 6). Caution also generates loss aversion for risky prospects when there is uncertainty over how to aggregate gains and losses. In that case, caution induces individuals to prefer \$0 to any 50/50 lottery over x and $-x$—that is, to exhibit loss aversion for risky prospects.[38] Cerreia-Vioglio, Dillenberger, and Ortoleva (forthcoming, Section 3.3) provides an in-depth discussion.

Cautious Utility can explain our findings. First, the model can generate the endowment effect for lotteries independently of loss aversion for risky prospects. Intuitively, this happens when the uncertainty inducing loss aversion for risky prospects is not the same one inducing the endowment effect for lottery tickets. Appendix E provides a complete example with numerical values. It is worth noting that the model does not imply that these two behaviors *must* be unrelated—the relationship depends on the joint distribution of parameters that determine cautious behavior in each setting.

Cautious Utility is also compatible with Findings 2 and 3. In the example above, WTP comes from u_1, while WTA comes from u_2. If these utilities vary independently across participants, then

[37]To see how this follows from the functional form above, note that the WTP is the amount x such that $(0,0)$ is indifferent to $(-x, 1)$. Applying the functional form, we have $\inf\{0,0\} = \inf\{-x+1, -x+2\}$, giving us $x = 1$. The WTA is the amount y such that $(0,0)$ is indifferent to $(y, -1)$, thus $\inf\{0,0\} = \inf\{y-1, y-2\}$, giving us $y = 2$.

[38]For a simple example, consider a typical functional form used in Prospect Theory: $u_{\alpha^+,\alpha^-} : \mathbb{R} \to \mathbb{R}$ where

$$u_{\alpha^+,\alpha^-}(t) = \begin{cases} t^{\alpha^+} & \text{if } t \geq 0 \\ -(-t)^{\alpha^-} & \text{if } t < 0 \end{cases}$$

for $\alpha^+, \alpha^- \in \mathbb{R}_{++}$. Suppose the individual is risk-averse for gains and risk-seeking for losses ($\alpha^+, \alpha^- < 1$), but is unsure of the exact curvature—for example, $\mathcal{W} = \{u_{\alpha^+,\alpha^-}(x) : \alpha^+, \alpha^- \in \{.25, .5\}\}$. To see how this will generate loss aversion for risky prospects, consider the lottery $\frac{1}{2}x + \frac{1}{2}(-x)$. Caution induces the individual to apply the lowest possible valuation to such a lottery. Note that the valuation is negative if $\alpha^+ < \alpha^- < 1$, so caution means that the lottery is valued less than receiving \$0 for sure. This implies loss aversion for risky prospects.

WTA and WTP will move independently. Finally, Cerreia-Vioglio, Dillenberger, and Ortoleva (forthcoming) also discuss an alternative version of the model (called *Incautious*) in which individuals assign an allocation the highest—instead of the lowest—value in the set when facing uncertainty. A cautious person is similar to someone who is ambiguity averse—over values, rather than probabilities—while an incautious person is similar to one who is ambiguity seeking.[39] This generates the negative endowment effect documented for a substantial minority of participants.

5.2 Salience

In the model of Salience, individuals overweight *salient* attributes of goods when evaluating different options. An attribute is salient if it "stands out" relative to other possible options under consideration, meaning that the perceived value of a potential choice is context-dependent. This model can generate an endowment effect for goods (Bordalo, Gennaioli, and Shleifer, 2012a), and has also been used to analyze behavior under risk, including loss aversion for risky prospects (Bordalo, Gennaioli, and Shleifer, 2012b).

Formally, an individual's true value of an object is given by $V = w_1 a_1 + w_2 a_2$, in the simple case in which options consist of only two attributes a_1 and a_2. For a physical good, attributes might include quality and/or price, for a lottery, attributes refer to possible payoffs. Salience leads to a distortion in the decision weights w_1 and w_2. For instance, if attribute 1 is salient, the individual distorts weights to w_1^{LT} and w_2^{LT}, such that $\frac{w_1^{\text{LT}}}{w_2^{\text{LT}}} = \frac{1}{\delta}\frac{w_1}{w_2}$, where $\delta \in (0,1]$ captures the neglect of non-salient features. That is, lower δ indicates a greater effect of salience on choices. $\delta = 1$ means that salience does not distort choices at all. The salience of each attribute is determined by a salience function σ and the *consideration set* of options against which an object is evaluated—typically, an attribute is more salient for a given object the more its value deviates from the average value in the consideration set.[40] Changes in the set of options being considered can thus change the salience of an attribute, and, consequently, the perceived value of a choice.

Bordalo, Gennaioli, and Shleifer (2012a) apply this model to explain the endowment effect for objects. An object is defined as a vector, $(q, -p)$, of two attributes, quality q and price p. Suppose these attributes are equally weighted in the absence of salience. When endowed with the object, an individual receives $(q, 0)$, which they compare to pre-experiment status quo, $(0, 0)$. The quality of the object is salient because the price does not vary in the consideration set. This increases the perceived value of the object—WTA for the object is WTA $= \frac{q}{\delta}$.[41] When evaluating WTP, the

[39] Experimental studies of ambiguity attitudes show that a significant minority of participants is ambiguity seeking. It is thus natural to expect that a significant minority of individuals are likely to be incautious.

[40] Specifically, a salience function is $\sigma(a_k, \bar{a}_k) \geq 0$, where $\bar{a}_k$ is the average value of attribute k across all options under consideration, and must satisfy several conditions. A typical example is $\sigma(a_k, \bar{a}_k) = \frac{|a_k - \bar{a}_k|}{|a_k| + |\bar{a}_k|}$. See Bordalo, Gennaioli, and Shleifer (2012b) for details.

[41] In an initial "endowment stage," the consumer first considers the object as part of a consideration set with two elements: just the object $(q, 0)$ and the previous status quo $(0, 0)$, leading the object's value to be perceived as greater

consideration set is now $\{(q, -\text{WTP}), (0,0)\}$. As the individual considers quality and price together, both attributes are equally salient, giving WTP = q. The endowment effect $\frac{\text{WTA}}{\text{WTP}} = \frac{1}{\delta}$ is, therefore, a function of how much individuals are affected by salience. The more important salience is, the lower δ, and the greater the endowment effect.

Salience has also been used to study choice with risk, and can explain loss aversion for risky prospects, but has not been extended to capture the endowment effect for lottery tickets. Loss aversion for risky prospects may result from losses being more salient, or—similar to Prospect Theory—from an overweighting of losses relative to gains in the value function (which is independent of salience): see Bordalo, Gennaioli, and Shleifer (2012b). However, it is not straightforward to extend the model to capture the endowment effect for lottery tickets, for both technical and conceptual reasons. Technically, the model is discontinuous, so there may not be any certainty equivalent for some lotteries, including simple binary ones (Kontek, 2016; Bordalo, Gennaioli, and Shleifer, 2022). WTA and WTP may thus be undefined for these lotteries. Conceptually, there are multiple ways to define attributes when the endowment is risky. The most obvious route would be to integrate payments (WTA and WTP) in the lottery payoffs. In this case, an endowment effect would emerge if losses are overweighted—either because they are salient or because they are overweighted in the value function. It is possible that the model could be extended in other ways, such as treating the lotteries' attributes separately from the prices paid or received. However, this is speculative, and the implications are unclear. To our knowledge, the model does not provide a clearly defined endowment effect for lotteries, and so does not make unambiguous predictions relating to our empirical tests.

To the extent that we can draw conclusions, Salience Theory appears to predict a positive relationship between loss aversion for risky prospects and the endowment effect—contradicting our main result. If the endowment effect for lottery tickets is generated by an overweighting of losses in the value function, the same feature would also drive loss aversion for risky prospects, leading to a correlation between the two—as in Prospect Theory. We would also expect a positive correlation if salience leads to both loss aversion for risky prospects and the endowment effect for lottery tickets. In fact, the only way we can imagine the salience model accommodating Finding 1 would be if salience leads to an endowment effect for lottery tickets (in some way), while loss aversion for risky prospects is due to a different, and unrelated, feature that (somehow) does not affect the endowment effect for lottery tickets. We have been unable to produce this result.

Salience also has difficulty explaining Findings 2 and 3. Recall that the value of the object affects both WTA and WTP, while salience affects only the WTA. Thus, a zero correlation between WTA and WTP only obtains if the value of the object has (close to) no variation, or if the two compensate each other precisely—as is the case under Prospect Theory. If there is little variation in the value of

than it actually is. In a following "trading stage", the consideration set becomes $(q,0)$, $(0,0)$, and $(0,\text{WTA})$. The higher perceived value from the endowment stage is passed to the trading stage with probability γ, which we set equal to 1 for simplicity. See Bordalo, Gennaioli, and Shleifer (2012b, Equation 5).

the object, this would imply little variation in WTP, which is not what we observe. Finally, to obtain a negative endowment effect, one needs to posit that individuals underweight salient attributes ($\delta > 1$), a possibility that, to our knowledge, has not been discussed in previous work on salience, and that appears contrary to the cognitive foundations of the model.

In short, Salience Theory does not offer a clear explanation for our findings. This is perhaps unsurprising given that—in contrast to Cautious Utility, but similar to most existing theories of the endowment effect—the model was developed prior to the release of this paper, and, naturally, focused on explaining the empirical evidence available at the time. Moreover, as discussed above, straightforward applications of the theory lead to predictions in line with the conventional wisdom reflected in our expert survey—positive relationships between loss aversion and the endowment effect, and between WTA and WTP.

6 Relationship with the Literature

Finding 1. We are aware of only three studies investigating the relationship between the endowment effect and loss aversion for risky prospects. Those studies reach different conclusions: two (Dean and Ortoleva 2019, henceforth DO, and Gächter, Johnson, and Herrmann 2022, henceforth GJH) find a positive correlation between the two phenomena in convenience samples, and one study (Fehr and Kübler 2022, henceforth FK) finds no relationship in a representative sample.[42]

Some patterns emerge from considering these studies together with ours, although it is difficult to draw solid inferences by comparing only four studies that have many points of difference. The most apparent pattern is that the studies using larger and more representative samples find no correlation between the endowment effect and loss aversion. Our study uses a representative sample of the U.S. population with 4,000 participants, and FK studies a representative sample of the German population with 3,146 households. In contrast, DO uses data elicited from 190 students at Brown University, and GJH considers 360 randomly selected customers at a German car dealership.

Other aspects of these studies do not seem relevant to explaining differing results. The presence of a correlation does not seem to depend on the type of good over which the endowment effect is measured—that is, lotteries or physical goods. Our study and DO use lotteries, while GJH and FK use physical goods (of similar value to our lotteries). FK, DO, and GJH use in-person elicitations, while we use an online panel. FK uses hypothetical lotteries to elicit loss aversion over risky prospects with relatively larger (hypothetical) stakes. Finally, the elicitation method does not seem relevant, as both our study and DO use extremely similar MPLs.

[42]Fehr and Kübler (2022) was initiated after our initial working paper, and primarily focuses on the role of expectations in the endowment effect. It does not have the rich data on WTA, WTP, and risk aversion that allows us to show Findings 2 and 3. In a recent working paper, Campos-Mercade et al. (2022) find a modest positive correlation between loss aversion for risky prospects and labor supply decisions.

Table 6: Correlations between the endowment effect and loss and risk aversion in two student samples

Dependent Variable:	WTA/WTP		WTA–WTP	
Panel A: DOSE (Student Study 1 & 2; N = 806)				
Loss Aversion (λ)	0.01	0.01	0.03	0.03
	(.035)	(.035)	(.035)	(.035)
Risk Aversion ($1-\alpha$)		0.07**		0.03
		(.035)		(.035)
Panel B: FM-Mixed (Student Study 2; N = 437; ORIV)				
Loss Aversion (FM-Mixed)	0.09	0.10	0.12	0.15*
	(.091)	(.082)	(.083)	(.077)
Risk Aversion (Gains)		−0.12		−0.26**
		(.114)		(.102)
Panel C: Mixed (Student Study 1 & 2; N = 806; ORIV)				
Loss Aversion (Mixed)	−0.11**	−0.10**	−0.12***	−0.07
	(.051)	(.048)	(.048)	(.047)
Risk Aversion (Gains)		−0.02		−0.16**
		(.083)		(.075)

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

The biggest difference between our study and DO is the population studied. To examine whether there is evidence that this difference is driving contrasting results, we can examine subgroups in our data. DO studies a selected student sample, its measure of loss aversion for risky prospects is quite similar to FM-Mixed, and it measures the endowment effect as WTA−WTP. As shown previously in Table 3, we find some evidence that groups comprised of participants with measured intelligence in the top 5–10% of the U.S. population have a more positive correlation between loss aversion for risky prospects and the endowment effect when the former is measured using FM-Mixed, and the latter as WTA−WTP. However, we do not find evidence for a positive correlation among the most educated participants in our study.

Additionally, we can examine the correlation in a student sample from the University of Pittsburgh (described in Section 4.1). Table 6 replicates the analysis of Table 2 in data from two studies in this population (N = 806). There is a marginally significant positive correlation between the endowment effect and loss aversion for risky prospects, but only when loss aversion is measured as FM-Mixed, and the endowment effect as WTA−WTP.

Overall, these results suggest that an important driver of differences between studies is the population examined.[43] It appears that a positive correlation between the endowment effect and loss aversion for risky prospects may be present in selected samples, but does not extend broadly. Moreover, even within selected groups, it may be that correlations are positive only when using certain measures, but not others, pointing to some fragility of those results.

Findings 2 and 3. There is very little examination of either the correlation between WTA and WTP, or the negative endowment effect, in the previous literature. This is perhaps because most studies of the endowment effect use between-subjects designs that preclude estimates of the endowment effect at the individual level. We know of only three studies that report the correlation between WTA and WTP for lotteries: one finds a small positive correlation (Borges and Knetsch, 1998) in a very small ($N = 45$) sample, and the other finds a small negative correlation measured over hypothetical annuities (Brown et al., 2017). We are not aware of any studies reporting the share of participants with a negative endowment effect. As discussed in Section 4.3, a reanalysis of data from the five studies that have used within-person designs to study WTA and WTP in lotteries produces results consistent with these two findings.

Finding 4. Finding 4 relates to three sets of papers. First, as discussed in Section 4.4, existing evidence shows how multiple price lists may generate reference effects (Hershey and Schoemaker, 1985; Sprenger, 2015). Second, as also discussed in Section 4.4, our data relates to the literature on the multi-dimensionality of risk preferences. This literature is discussed in more detail in a companion paper, Chapman et al. (2023), which studies the pattern of correlations across a large number of behavioral regularities, including measures of social preferences and overconfidence.

Finally, Fehr and Kübler (2022), described above, find that their measure of the endowment effect is correlated with economic behaviors outside their survey—namely, moving and owning equities—suggesting, in line with our Finding 4, that features of the endowment effect are useful predictors of other economic behaviors.

7 Conclusion

The endowment effect occupies a prominent role in behavioral economics as it directly contradicts the core tenet of classical economic decision-making: that purchasing decisions and trade are guided by individuals having a unique, well-defined value for an object. Identifying the endowment effect's causes is central to developing theories that better explain economic decision-making, to improving our understanding of the endowment effect's implications, and to identifying how it can

[43]Note that differences in correlations across populations is not inconsistent with Snowberg and Yariv (2021). While that paper finds that many correlations are the same in representative and student samples, others (23 out of 55) are significant in one sample and insignificant in the other.

be reduced or eliminated using policy intervention. This paper empirically tackles questions related to the origin of the endowment effect using multiple large, representative, incentivized surveys to document several new findings about WTA, WTP, the endowment effect, and loss aversion for risky prospects.

Consistent with the earlier literature using convenience samples, we find that a majority of the general population exhibit an endowment effect for lotteries. However, we document four new findings: i) the endowment effect is unrelated to loss aversion for risky prospects, contradicting the standard explanation that ascribes the endowment effect to loss aversion; ii) WTA and WTP are not only different, but largely uncorrelated; iii) a substantial minority of participants exhibit a negative endowment effect—that is, WTA<WTP; and iv) WTA and WTP are related to different, independent features of risk preferences.

To reconcile theory with our data, the endowment effect needs to be decoupled from loss aversion under risk, and WTA and WTP need to be able to vary independently. To our knowledge, out of alternative theories, only Cautious Utility accommodates these features, and thus provides the most complete explanation of our results. More work is needed to test these theories as rigorously as we have tested the standard explanation of the endowment effect. Moreover, our findings suggest that WTA and WTP—or perhaps, more accurately, buying and selling—are independent phenomena that warrant study in their own right, rather than simply as components of the endowment effect. The processes underlying the valuation of tradable objects, whether on the buy side or sell side, are core to market activity, and merit greater attention from economists.

References

Anagol, Santosh, Vimal Balasubramaniam, and Tarun Ramadorai. 2018. "Endowment effects in the field: Evidence from India's IPO lotteries." *The Review of Economic Studies* 85 (4):1971–2004.

Andersen, Steffen, Glenn W. Harrison, Morten I. Lau, and E. Elisabet Rutström. 2006. "Elicitation Using Multiple Price List Formats." *Experimental Economics* 9 (4):383–405.

Andreoni, James and Charles Sprenger. 2012. "Risk Preferences Are Not Time Preferences." *American Economic Review* 102 (7):3357–3376.

Ashby, Nathaniel J.S. Stephan Dickert, and Andreas Glöckner. 2012. "Focusing on What You Own: Biased Information Uptake due to Ownership." *Judgment and Decision Making* 7 (3):254.

Barberis, Nicholas. 2018. "Richard Thaler and the rise of behavioral economics." *The Scandinavian Journal of Economics* 120 (3):661–684.

Beauchamp, Jonathan P., Daniel J. Benjamin, Christopher F. Chabris, and David I. Laibson. 2020. "Measuring and Controlling for the Compromise Effect when Estimating Risk Preference Parameters." *Experimental Economics* 23:1069–1099.

Becker, Gordon M., Morris H. DeGroot, and Jacob Marschak. 1964. "Measuring Utility by a Single-Response Sequential Method." *Behavioral Science* 9 (3):226–232.

Bewley, Truman F. 1986. "Knightian Decision Theory: Part I." *Cowles Foundation discussion paper* 807.

Bordalo, Pedro, Nicola Gennaioli, and Andrei Shleifer. 2012a. "Salience in Experimental Tests of the Endowment Effect." *American Economic Review: Papers and Proceedings* 102 (3):47–52.

———. 2012b. "Salience Theory of Choice under Risk." *The Quarterly Journal of Economics* 127 (3):1243–1285.

———. 2022. "Salience." *Annual Review of Economics* 14:521–544.

Borges, Bernhard F.J. and Jack L. Knetsch. 1998. "Tests of Market Outcomes with Asymmetric Valuations of Gains and Losses: Smaller Gains, Fewer Trades, and Less Value." *Journal of Economic Behavior & Organization* 33 (2):185–193.

Brown, Jeffrey R. Arie Kapteyn, Erzo F.P. Luttmer, and Olivia S. Mitchell. 2017. "Cognitive Constraints on Valuing Annuities." *Journal of the European Economic Association* 15 (2):429–462.

Butler, David and Graham Loomes. 2007. "Imprecision as an Account of the Preference Reversal Phenomenon." *American Economic Review* 97 (1):277–297.

Campos-Mercade, Pol, Lorenz Goette, Thomas Graeber, Alexandre Kellogg, and Charles Sprenger. 2022. "Heterogeneity of gain-loss attitudes and expectations-based reference points." Tech. rep., Working Paper.

Carmon, Ziv and Dan Ariely. 2000. "Focusing on the Forgone: How Value can Appear so Different to Buyers and Sellers." *Journal of Consumer Research* 27 (3):360–370.

Cerreia-Vioglio, Simone, David Dillenberger, and Pietro Ortoleva. forthcoming. "Caution and Reference Effects." *Econometrica* .

Chapman, Jonathan, Mark Dean, Pietro Ortoleva, Erik Snowberg, and Colin Camerer. 2023. "Econographics." *Journal of Political Economy: Microeconomics* 1 (1):115–161.

Chapman, Jonathan, Erik Snowberg, Stephanie Wang, and Colin Camerer. 2024. "Dynamically Optimized Sequential Experimentation (DOSE) for Estimating Economic Preference Parameters." Mimeo.

Chapman, Jonathan, Erik Snowberg, Stephanie Wang, and Colin F. Camerer. forthcoming. "Looming Large or Seeming Small? Attitudes Towards Losses in a Representative Sample." *Review of*

Economic Studies .

Condon, David M. and William Revelle. 2014. "The International Cognitive Ability Resource: Development and Initial Validation of a Public-domain Measure." *Intelligence* 43 (2):52–64.

Cubitt, Robin, Daniel Navarro-Martinez, and Chris Starmer. 2015. "On Preference Imprecision." *Journal of Risk and Uncertainty* 50 (1):1–34.

De Martino, Benedetto, Dharshan Kumaran, Beatrice Holt, and Raymond J Dolan. 2009. "The Neurobiology of Reference-Dependent Value Computation." *The Journal of Neuroscience* 29 (12):3833–3842.

Dean, Mark and Pietro Ortoleva. 2019. "The empirical relationship between nonstandard economic behaviors." *Proceedings of the National Academy of Sciences* 116 (33):16262–16267.

DellaVigna, Stefano, Devin Pope, and Eva Vivalt. 2019. "Predict Science to Improve Science." *Science* 366 (6464):428–429.

Dubourg, W. Richard, Michael W. Jones-Lee, and Graham Loomes. 1994. "Imprecise Preferences and the WTP-WTA Disparity." *Journal of Risk and Uncertainty* 9 (2):115–133.

Eisenberger, Roselies and Martin Weber. 1995. "Willingness-to-pay and Willingness-to-accept for Risky and Ambiguous Lotteries." *Journal of Risk and Uncertainty* 10 (3):223–233.

Ericson, Keith M. Marzilli and Andreas Fuster. 2014. "The Endowment Effect." *Annual Review of Economics* 6 (1):555–579.

Fehr, Dietmar, Rustamdjan Hakimov, and Dorothea Kübler. 2015. "The Willingness to Pay-Willingness to Accept Gap: A Failed Replication of Plott and Zeiler." *European Economic Review* 78:120–128.

Fehr, Dietmar and Dorothea Kübler. 2022. "The Endowment Effect in the General Population." University of Heidelberg, *mimeo.*

Frederick, Shane. 2005. "Cognitive Reflection and Decision Making." *The Journal of Economic Perspectives* 19 (4):25–42.

Friedman, Daniel, R. Mark Isaac, Duncan James, and Shyam Sunder. 2014. *Risky Curves: On the Empirical Failure of Expected Utility*. Routledge.

Gächter, Simon, Eric J. Johnson, and Andreas Herrmann. 2022. "Individual-level Loss Aversion in Riskless and Risky Choices." *Theory and Decision* 92:599—-624.

Gillen, Ben, Erik Snowberg, and Leeat Yariv. 2019. "Experimenting with Measurement Error: Techniques and Applications from the Caltech Cohort Study." *Journal of Political Economy* 127 (4):1826–1863.

Gupta, Neeraja, Luca Rigotti, and Alistair Wilson. 2021. "The Experimenters' Dilemma: Inferential Preferences over Populations." *arXiv preprint arXiv:2107.05064* .

Harless, David W. 1989. "More Laboratory Evidence on the Disparity between Willingness to Pay and Compensation Demanded." *Journal of Economic Behavior & Organization* 11 (3):359–379.

Hershey, John C. and Paul J.H. Schoemaker. 1985. "Probability Versus Certainty Equivalence Methods in Utility Measurement: Are they Equivalent?" *Management Science* 31 (10):1213–1231.

Holt, Charles A. and Susan K. Laury. 2002. "Risk Aversion and Incentive Effects." *American Economic Review* 92 (5):1644–1655.

Holzmeister, Felix and Matthias Stefan. 2021. "The Risk Elicitation Puzzle Revisited: Across-Methods (In)consistency?" *Experimental Economics* 24 (2):593–616.

Horowitz, John K. and Kenneth E. McConnell. 2004. "A Review of WTA/WTP Studies." *Journal of Environmental Economics and Management* 44 (3):426–447.

Hu, Sien, Yuan-Chi Tseng, Alissa D Winkler, and Chiang-Shan R Li. 2014. "Neural bases of individual variation in decision time." *Human brain mapping* 35 (6):2531–2542.

Isoni, Andrea, Graham Loomes, and Robert Sugden. 2011. "The Willingness to Pay-Willingness to Accept Gap, the 'Endowment Effect,' Subject Misconceptions, and Experimental Procedures for Eliciting Valuations: Comment." *American Economic Review* 101 (2):991–1011.

Johnson, Eric J., Gerald Häubl, and Anat Keinan. 2007. "Aspects of Endowment: A Query Theory of Value Construction." *Journal of Experimental Psychology: Learning, Memory, and Cognition* 33 (3):461.

Kachelmeier, Steven J. and Mohamed Shehata. 1992. "Examining Risk Preferences under High Monetary Incentives: Experimental Evidence from the People's Republic of China." *American Economic Review* 82 (5):1120–1141.

Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler. 1990. "Experimental Tests of the Endowment Effect and the Coase Theorem." *Journal of Political Economy* 98 (6):1325–1348.

———. 1991. "Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias." *Journal of Economic Perspectives* 5 (1):193–206.

Kahneman, Daniel and Amos Tversky. 1979a. "Prospect Theory: An Analysis of Choice under Risk." *Econometrica* 47 (2):263–291.

———. 1979b. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 47 (2):263–292.

Klass, Gregory and Kathryn Zeiler. 2013. "Against endowment theory: experimental economics and legal scholarship." *Ucla L. Rev.* 61:2.

Knetsch, Jack L, Yohanes E Riyanto, and Jichuan Zong. 2012. "Gain and loss domains and the choice of welfare measure of positive and negative changes." *Journal of Benefit-Cost Analysis* 3 (4).

Knetsch, Jack L. and J. A. Sinden. 1984. "Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value." *The Quarterly Journal of Economics* 99 (3):507–521.

Knutson, Brian, G.Ẽlliott Wimmer, Scott Rick, Nick G Hollon, Drazen Prelec, and George Loewenstein. 2008. "Neural Antecedents of the Endowment Effect." *Neuron* 58 (5):814–822.

Kontek, Krzysztof. 2016. "A critical note on salience theory of choice under risk." *Economics Letters* 149:168–171.

Kőszegi, Botond and Matthew Rabin. 2006. "A Model of Reference-Dependent Preferences." *Quarterly Journal of Economics* 121 (4):1133–1165.

———. 2007. "Reference-Dependent Risk Attitudes." *The American Economic Review* 97 (4):1047–1073.

Krajbich, Ian, Bastiaan Oud, and Ernst Fehr. 2014. "Benefits of neuroeconomic modeling: New policy interventions and predictors of preference." *American Economic Review* 104 (5):501–506.

List, John A. 2004. "Neoclassical Theory Versus Prospect Theory: Evidence from the Marketplace." *Econometrica* 72 (2):615–625.

Loomes, Graham, Chris Starmer, and Robert Sugden. 2003. "Do Anomalies Disappear in Repeated Markets?" *The Economic Journal* 113 (486):C153–C166.

Marzilli Ericson, Keith M and Andreas Fuster. 2014. "The Endowment Effect." *Annual Review of Economics* 6 (1):555–579.

Masatlioglu, Yusufcan and Efe A. Ok. 2005. "Rational Choice with Status-Quo Bias." *Journal of Economic Theory* 121:1–29.

———. 2014. "A Canonical Choice Model with Initial Endowment." *Review of Economic Studies*

81 (2):851–883.
Mazar, Nina, Botond Kőszegi, and Dan Ariely. 2014. "True Context-Dependent Preferences? The Causes of Market-Dependent Valuations." *Journal of Behavioral Decision Making* 27 (3):200–208.
Meyer, Philip A. 1979. "Publicly Vested Values for Fish and Wildlife: Criteria in Economic Welfare and Interface with the Law." *Land Economics* 54 (2):223–235.
Morewedge, Carey K. and Colleen E. Giblin. 2015. "Explanations of the endowment effect: an integrative review." *Trends in Cognitive Sciences* 19 (6):339–348.
Nayakankuppam, Dhananjay and Himanshu Mishra. 2005. "The Endowment Effect: Rose-tinted and Dark-tinted Glasses." *Journal of Consumer Research* 32 (3):390–395.
O'Donoghue, Ted and Charles Sprenger. 2018. "Reference-dependent Preferences." In *Handbook of Behavioral Economics: Applications and Foundations 1*, vol. 1. Elsevier, 1–77.
Ortoleva, Pietro. 2010. "Status Quo Bias, Multiple Priors and Uncertainty Aversion." *Games and Economic Behavior* 69 (2):411–424.
Pachur, Thorsten and Benjamin Scheibehenne. 2012. "Constructing Preference from Experience: The Endowment Effect Reflected in External Information Search." *Journal of Experimental Psychology: Learning, Memory, and Cognition* 38 (4):1108–1116.
Pedroni, Andreas, Renato Frey, Adrian Bruhin, Gilles Dutilh, Ralph Hertwig, and Jörg Rieskamp. 2017. "The Risk Elicitation Puzzle." *Nature Human Behaviour* 1:803–809.
Pew Research Center. 2016. *Evaluating Online Nonprobability Surveys*. www.pewresearch.org.
Plott, Charles R. and K. Zeiler. 2005. "The Willingness to Pay-Willingness to Accept Gap, The 'Endowment Effect,' Subject Misconceptions, and Experimental Procedures for Eliciting Valuations." *American Economic Review* 95 (3):530–545.
Schmidt, Ulrich, Chris Starmer, and Robert Sugden. 2008. "Third-Generation Prospect Theory." *Journal of Risk and Uncertainty* 36 (3):203–223.
Schmidt, Ulrich and Stefan Traub. 2009. "An Experimental Investigation of the Disparity between WTA and WTP for Lotteries." *Theory and Decision* 66 (3):229–262.
Schmidt, Ulrich and Stefan T. Trautmann. 2014. "Common Consequence effects in Pricing and Choice." *Theory and Decision* 76 (1):1–7.
Shogren, Jason, Seung Y. Shin, Dermot J. Hayes, and James B. Kliebenstein. 1994. "Resolving Differences in Willingness to Pay and Willingness to Accept." *American Economic Review* 84 (1):255–270.
Smitizsky, Gal, Wendy Liu, and Uri Gneezy. 2021. "The endowment effect: Loss aversion or a buy-sell discrepancy?" *Journal of Experimental Psychology: General* 150 (9):1890–1900.
Snowberg, Erik and Leeat Yariv. 2021. "Testing the Waters: Behavior across Subject Pools." *American Economic Review* 111 (2):687–719.
Sprenger, Charles. 2015. "An Endowment Effect for Risk: Experimental Tests of Stochastic Reference Points." *Journal of Political Economy* 123 (6):1456–1499.
Stantcheva, Stefanie. 2022. "How to Run Surveys: A Guide to Creating Your Own Identifying Variation and Revealing the Invisible." NBER Working Paper #30,527.
Tong, Lester C.P., Karen J. Ye, Kentaro Asai, Seda Ertac, John A. List, Howard C. Nusbaum, and Ali Hortaçsu. 2016. "Trading Experience Modulates Anterior Insula to Reduce the Endowment Effect." *Proceedings of the National Academy of Sciences* 113 (33):9238–9243.
Tunçel, Tuba and James K. Hammitt. 2014. "A New Meta-Analysis on the WTP/WTA Disparity." *Journal of Environmental Economics and Management* 68 (1):175–187.
Tversky, Amos and Daniel Kahneman. 1991. "Loss Aversion in Riskless Choice: A Reference-

Dependent Model." *Quarterly Journal of Economics* 106 (4):1039–1061.
Vosgerau, Joachim and Eyal Peer. 2018. "Extreme Malleability of Preferences: Absolute Preference Sign Changes under Uncertainty." *Journal of Behavioral Decision Making* 32 (2):38–46.
Weaver, Ray and Shane Frederick. 2012. "A Reference Price Theory of the Endowment Effect." *Journal of Marketing Research* 49 (5):696–707.