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Ori Heffetz
John A. List

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1050 Massachusetts Avenue
Cambridge, MA 02138
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ABSTRACT

This paper is aimed to assess, with two lab experiments, to what extent Kőszegi and Rabin's (2006) model of expectations-based reference-dependent preferences can explain Knetsch's (1989) endowment effect. Departing from past work, we design an experiment that treats the two goods (a mug and a pen) symmetrically in all but in the probabilities with which they are expected to be owned. Thus, our "endowmentless" endowment effect experiment shuts down all alternative mechanisms while leaving expectations the only difference between treatments. We find no evidence that expectations alone can reproduce any of the original effect.

Ori Heffetz
324 Sage Hall
Cornell University
Ithaca, NY 14853
oh33@cornell.edu

John A. List
Department of Economics
University of Chicago
1126 East 59th
Chicago, IL 60637
and NBER
jlist@uchicago.edu

1 Introduction

A substantial body of experimental evidence has accumulated since Knetsch's (1989) first 'endowment effect' demonstration, where most subjects chose to keep a randomly-assigned owned object rather than trade it for another.[1] While numerous subsequent studies replicate the original result, recent findings show that the effect may shrink or disappear among market-experienced subjects (List, 2004), among lab subjects who are trained to trade (Engelmann and Hollard, 2010), or under specific experimental procedures (Plott and Zeiler, 2007).

This large and growing body of experimental evidence is interpreted differently by different observers. In one common interpretation, the effect is seen as evidence of loss aversion, and experiments where it is found are seen as supporting Kahneman and Tversky's prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991). According to prospect theory, an individual evaluates economic outcomes by comparing them with a reference point (for example, comparing potential consumption bundles with a currently owned one), and by weighing losses (relative to said reference point) more heavily than gains.[2] Under this view, experiments where the effect is not found are seen either as instances that lie outside the domain where prospect theory is expected to hold, or as instances where ownership is not sufficiently emphasized to subjects—or is not expected by subjects (e.g. experienced traders) to last—and hence where a reference point is not properly established.

On the other hand, according to a competing interpretation, all findings to date are largely consistent with neoclassical (reference-independent) preferences. Holders of this view interpret the many replications of the effect as resulting from incomplete information, uncertainty, or ambiguity regarding the objects, context, and other factors that may affect costs

[1] The term 'endowment effect' was coined by Thaler (1980), who predicted that a good's value to an individual would increase once it became part of her endowment.

[2] These are not the only components of prospect theory. The theory also assumes, e.g., that utility is concave in gains and convex in losses, and that individuals weight probabilities. However, these other components of the theory are not necessary for predicting the endowment effect, and have typically not been discussed in its context.

and benefits as perceived by subjects. Finally, a third alternative views some findings as consistent with prospect theory and others as consistent with standard theory. According to this view, each theory predicts behavior under a different set of circumstances.

That the same body of evidence coexists with different interpretations is far from surprising. But a disagreement regarding interpretation is less likely to last when virtually all the relevant evidence comes from experiments that are relatively straightforward to replicate, tweak, and refine, and when the main competing theories make predictions that are so different. According to prospect theory, economic behavior depends on a reference point; according to neoclassical theory, it does not. What could have prevented experimentalists from designing variations of the original experiment to convincingly test between the theories?

One answer is that for a long time, a clean test was impossible to devise because, as suggested above, prospect theory is practically unfalsifiable unless it specifies how the reference point is determined. Without an explicit theory that would state which components in past experiments are crucial for establishing the reference point and which components can—and, to prevent neoclassical theory from explaining the effect, should—be left out, both theories can accommodate a wide range of findings.

Fortunately, this situation has been changing recently, with new theoretical developments that open the door for such tests. One example is Kőszegi and Rabin's (2006) (henceforth KR) model of reference-dependent preferences, which seems to be increasingly recognized as the gold standard in the literature. KR propose a formal theory of reference-point determination: it is determined by expectations—"a person's reference point is the probabilistic beliefs she held in the recent past about outcomes." Furthermore, by combining their model with a specific theory of expectations formation—requiring expectations to be rational, and requiring individuals to select those (rational) expectations that maximize expected utility—KR put enough structure to render the theory substantially more falsifiable. And although, as they repeatedly note, what is meant by "recent past" is still open for interpretation, their combined model makes specific (and hence, testable) predictions.

The goal of our paper is to assess, with two lab experiments, to what extent KR's model of reference-dependent preferences can explain Knetsch's (1989) findings. For this purpose, we design a version of the original experiment where instead of endowing individuals with a good and then surprising them with an offer to trade it for another, we replace endowment with expectations—in the form of clear and reliable probabilistic information regarding the possibilities and choices subjects will face during the entire experiment—and we replace surprise with a realization of one of these expected possibilities. Furthermore, our design is such that it is not subject to any of the confounds suggested in the literature in the past, such as various transaction costs, informational confounds, and demand effects (Plott and Zeiler, 2007); or "trade uncertainty" (Engelmann and Hollard, 2010).

In our first experiment, we present 102 subjects with two goods (a mug and a pen) and ask them to toss a coin which, as the subjects consequently learn, determines which of the two goods is "assigned" to them. What "assigned" means differs by treatment. In our Weak Reference treatment, subjects will get the assigned item as a gift with 1% probability, and with 99% probability they will be able to choose which of the two items will be their gift. In our Strong Reference treatment, these probabilities are reversed: subjects will get the assigned object with 99% probability, and with 1% probability they will be able to choose their gift. We use a quiz to verify that subjects fully understand these probabilities and, hence, that they form expectations as intended by our treatments. Importantly, endowment is entirely absent from our experiment, and is fully replaced by these expectations.

In our second experiment (with 434 subjects) we add a dimension to our first experiment whereby we also examine to what extent the very experimental procedures we use for establishing subjects' expectations regarding their outcomes may act differently on subjects whose own outcomes are, by design, not affected by these procedures. Specifically, a subset of our subjects go through the coin-toss, instructions, and quiz while knowing all along that these procedures affect others, but not them. Hence our second experiment takes a further step in disentangling expectations not only from endowment, but also from the procedures

we use for controlling expectations in the lab.

To the extent that endowment affects outcomes through establishing expectations (regarding outcomes), by removing endowment and instead directly establishing expectations one should be able to replicate the effect, at least partially. This has indeed been suggested by recent experimental work (Knetsch and Wong, 2009; Ericson and Fuster, 2010).[3] By shutting off all previously-offered alternative explanations and potential mechanisms other than the expectations channel, we thus ask: *How much of the endowment effect can be explained as an expectations-based reference effect à la KR, and how much of it requires other explanations like endowment, experimental procedures, etc.?*[4]

The answer that emerges from our two experiments is that we find virtually no evidence that expectations alone—without actual endowment—can reproduce any part of the original effect. Specifically, in our first experiment we find that while subjects are more likely to choose the good assigned to them by the coin-flip, they are not more likely to do so in the Strong Reference treatment than in the Weak Reference treatment, and hence their behavior cannot be explained by expectations. In our second experiment, despite having a large subject pool, the only differences in choices we find across coin-flips and experimental treatments are small, often far from statistically significant, and often with the opposite sign of KR's predictions. These findings are especially important given the size of the original effect. In Knetsch's (1989) experiment, once subjects are endowed with a good (either a mug or a chocolate bar), they are at least eight times more likely to keep it than to trade it for the alternative good. This result has been replicated many times, often with similarly large difference in proportions (see, e.g., List, 2004).

Our findings should hold import for academics as well as for policymakers. For economists,

[3]We discuss this work in the next section.

[4]As suggested above, KR's model consists of three components: (a) prospect theory's value function; (b) a reference point that is determined by expectations; and (c) a theory of rational expectations. KR note that the last component—the assumption that the expectations that determine the reference point are "fully rational" (in a sense spelled out in their model)—could be replaced by "any theory of how these expectations are formed. But as a disciplined and largely realistic first pass," KR "assume that expectations are fully rational." Notice that the present paper is not aimed at asking to what extent the different components of KR's theory explain the endowment effect, but rather to what extent the *combined* theory explains it.

determining why preferences are so often found to depend on initial endowments merits serious effort. If part of the explanation is that preferences are defined not only over absolute outcomes but also over the differences between outcomes and an expectations-based reference point, then a re-evaluation of our modeling assumptions is necessary, e.g. regarding how expectations relate to the basic independence assumption. At the same time, if expectations alone cannot explain the endowment effect, then one would want a general theory to specify what it is about actual ownership—or, at least, about actual ownership as it is often implemented in lab experiments—that seems to change preferences so dramatically. For policymakers, resolving this issue is invaluable for cost-benefit analysis and, more generally, for any computation involving welfare analysis.

The remainder of our study proceeds as follows. Section 2 discusses recent relevant work and provides the general theoretical framework that motivates the design of our first experiment. Section 3 presents the results from our first experiment. Section 4 describes the design and results of our second experiment. Section 5 concludes.

2 Testing for a Reference Effect

In this section we briefly outline a simple version of KR's model, describe our first experiment, and solve the model in the context of our experiment. Before doing so, we place our experiment (and its findings as described above) in the context of two recent related studies.

2.1 Endowment, Reference, and Expectations

Of the related literature, the paper that is closest to ours is Ericson and Fuster (2010). In independent work, they demonstrate the potential of KR to explain at least some of Knetsch's (1989) original effect. In contrast to our work, however, they do not attempt to ask *how much* of the (very large) original effect can in fact be attributed to KR. And while they find that expectations *could* explain some of the effect, we find no evidence that they

do.

Ericson and Fuster endow 45 subjects with a mug, and flip a coin to determine the probability with which subjects will be allowed to trade it later for a pen; the probability can be either 10% (a strong reference treatment) or 90% (a weak reference treatment). They find that 77% and 44% of mug owners, respectively, choose to keep the mug in the two treatments. On the other hand, they find the opposite result—38% and 71%, respectively, choose to keep the mug—when instead of flipping a coin in the presence of subjects they randomly assign 63 subjects to one of the two treatments in a manner not transparent to the subjects. As they observe, while the latter design is confounded along the lines suggested by Plott and Zeiler (2007)—the probability with which a subject is allowed to trade the mug may itself be perceived by subjects as conveying information regarding the mug's value—the latter result is also informative regarding the relative strength of the expectations channel as a potential driver of the effect. Overall, their findings above may suggest that once a good is endowed, information (or value signals) and expectations interact in a way that gives expectations an important role in setups where value signals are absent but a lesser role where they are present; while our findings—which are not subject to the above confound—may suggest that when endowment itself is entirely absent, the role of expectations alone is reduced even when value signals are absent as well.

To the best of our knowledge, our paper and the concurrent work of Ericson and Fuster are the first direct tests of predictions of a fully-specified version of prospect theory in the context of Knetsch's (1989) original experiment.[5] However, we are not the first to run endowment effect experiments that are motivated by KR's theory. Knetsch and Wong (2009) demonstrate that ownership and endowment may not be the only—or even the main—drivers of the effect, and propose that the effect should hence be renamed a 'reference effect.' They hypothesize that the effect is triggered by endowment and ownership only in contexts

[5]Recent work tests KR's model in contexts other than Knetsch's (1989) original experiment. For example, Abeler et al. (forthcoming) test the model's predictions for effort provision. See also Smith (2008), who tests for a WTP-WTA gap, and Ericson and Fuster's (2010) WTA experiment.

where—and only to the extent that—endowment and ownership happen to influence subjects' expectations, and they present evidence that is consistent with this interpretation. However, since they do not explicitly control (or verify) expectations, interpreting their experiments in light of KR requires speculation similar to the speculation that is required when interpreting the original experiment and many of its variants. In contrast, our experiments directly control expectations by fully informing subjects, right from the outset, regarding both exact experimental procedures and complete probability distributions over the choice sets they might face. By systematically varying these probability distributions and hence—according to KR—the reference point, we can directly test to what extent the endowment effect is a reference effect.

2.2 The General KR Framework

In KR's model, a consumer's utility depends not only on her K-dimensional consumption vector $\boldsymbol{c}$ but also on a reference vector $\boldsymbol{r}$. Her overall utility,

$$u\left(\boldsymbol{c}|\boldsymbol{r}\right) = \sum_{k} m_k\left(c_k\right) + \sum_{k} \mu(m_k\left(c_k\right) - m_k\left(r_k\right)),$$

consists of two components, both separable across dimensions. The first, "consumption utility," corresponds to standard, 'classic,' utility. The second, "gain-loss utility," corresponds to prospect theory's reference-dependent utility. The value function μ satisfies $\mu\left(x\right) = \eta x$ for $x > 0$, and $\mu\left(x\right) = \eta\lambda x$ for $x \leq 0$. The parameter $\eta > 0$ is the weight an individual attaches to gain-loss utility, and $\lambda > 1$ is her "coefficient of loss-aversion." Hence λ is a measure of prospect theory's famous "kink": the pain from a(n arbitrarily small) loss is greater than the pleasure from a gain of equal size. The model allows for both $\boldsymbol{c}$ and $\boldsymbol{r}$ to be stochastic, and assumes that individuals maximize expected utility.

As noted above, in KR's version of prospect theory, the reference vector $\boldsymbol{r}$ results from expectations. "Specifically, a person's reference point is her probabilistic beliefs about the

relevant consumption outcome held between the time she first focused on the decision determining the outcome and shortly before consumption occurs" (Kőszegi and Rabin, 2006).

The reference $\boldsymbol{r}$ is determined endogenously, as what KR term a *preferred personal equilibrium* (PPE). A PPE is a probability distribution over consumption outcomes that satisfies the following two conditions. First, it is a *personal equilibrium* (PE), which is a rational expectations equilibrium in the following sense. Given a consumer's expectations regarding the state of the world—represented by a probability distribution over *choice sets*—she forms expectations regarding choice outcomes—a probability distribution over *consumption vectors*. These expectations over outcomes are rational in that they are consistent: a consumer who holds them as her reference will indeed find that following through (by making the ex ante expected choices) maximizes her utility.

Second, a PPE is a preferred PE: when more than one PE exists, a PPE is the one that maximizes ex ante expected utility. In other words, when the consumer can form more than one set of expectations regarding outcomes which, once her reference, is consistent with optimal choices ex post—she will choose as her reference point the ex ante preferred one. For a formal exposition and a detailed discussion see Kőszegi and Rabin (2006).

2.3 Application: The Reference Effect

We now apply KR's model to our first experiment. The main contribution of our experiment is that it directly manipulates a subject's expectations regarding the choice sets she will face. We do this by directly and explicitly informing her about the relevant probabilities. With no ambiguity regarding her expectations—which we verify with a quiz (see below)—we can solve the model and derive testable predictions.

2.3.1 Experiment 1: Design

Our first experiment involves two consumption goods, a mug and a pen, which we denote below c_i and c_j. It is conducted at a large university in the Midwest. Each experimental

subject is seated at a table, on which the two goods are located, along with a set of printed instructions, a printed survey, a coin, an envelope, and something to write with (for a photo of the experimental setup and for an example of the experimental instructions see Appendix A).

On the first page of the instructions subjects are asked to flip a coin and to choose a number between 1 and 100. The experimental procedure is explained on the second page, which subjects are allowed to see only after they marked down on the first page both their coin-flip outcome and their choice of a number. In our Strong Reference treatment, the second page opens with the text:

> In front of you are two items. You will get one of them as a gift to take home. Whether or not you can choose your gift is determined at random, as explained below in detail.
>
> In brief, there is a 1% probability that you will be able to choose which item you take home. However, there is a 99% probability that you will NOT be able to choose, and that your gift will automatically be the pen if you flipped "heads" and automatically be the mug if you flipped "tails."
>
> Feel free to inspect the items but please return them both to their places before we continue.

The text in our complementary Weak Reference treatment is identical, but "1%" above is replaced with "99%," and "99%" above is replaced with "1%." The rest of the second page of the instructions explains the experimental protocol in detail, including explaining how the 1% vs. 99% randomization will be carried out (the sealed envelope next to the subject contains a number between 1 and 100, which has a 1% probability of matching the number the subject wrote on the first instructions page). In addition, the explanation above regarding probabilities is repeated, using alternative—and perhaps more intuitive—descriptions. For example, in the Strong Reference treatment:

> Notice that you have a 1% chance (or 1/100) to be able to choose your gift at the end of the survey. In other words, there is a very high probability that you will take home the gift determined by the coin-flip, regardless of which gift you choose.

Subjects are then asked if they have questions. After any questions are answered by the experimenter, they proceed to the third page, which includes two quiz questions to verify that they indeed understood the instructions and formed correct expectations regarding the probabilities of future consumption of either good given their expected choice. The quiz is identical across treatments, and is constructed in a way that leaves little chance for answering it correctly without full understanding of the exact probabilities with which each potential outcome can occur.

Once subjects finish the quiz, the experimenter checks their answers, and they then proceed to fill out a survey (to pass time).[6] Having completed the survey, they are asked to make their choice of an item. Their choice is our outcome of interest.[7] (After having made this choice, on the last page of the instructions subjects are asked hypothetical WTP questions; the 1% vs. 99% uncertainty is resolved; and subjects' comments are solicited.)

This experimental design has a few important features. First, the goods are treated symmetrically, and the instructions contain no biased language like "keep" or "trade" that might affect subjects' choices. Second, the coin-flip guarantees that subjects are aware that their default gift resulted from a random 50-50 draw. It rules out the concern that a good's assignment as a default gift may be interpreted by subjects as informative, e.g. regarding the goods' values (a quality signal) or regarding the "right" choice behavior expected by the experimenter (demand effects). These concerns, which are raised by Plott and Zeiler (2007),

[6]Subjects who did not answer both quiz questions correctly are informed that they have incorrect answers and are asked to re-read the instructions and try again. If they again have mistakes, the experimenter goes over the instructions and quiz with them for a third time, and then asks them to proceed regardless of their answers. Importantly, we record the number of attempts it took each subject to answer the quiz correctly, and use it as a measure of how confident we are that a subject formed expectations as intended.

[7]Notice that we record gift choices before the 1% vs. 99% uncertainty is resolved, hence before subjects find out whether they will get their choice or the gift assigned by the coin-flip. This allows us to elicit real-stake choices from all subjects (rather than from only the fraction of them who happens to end up in the choice condition). On the other hand, with this design we cannot test whether subjects' choices once they know which condition they face are consistent with their ex ante choice-expectations. It would be interesting to test this aspect of the model in the future, for example by modifying the design to record choice only after the (choice vs. assigned gift) uncertainty is resolved. Notice however that this will require $1/q$ times more subjects, where $q = 0.01$ in one treatment, and $q = 0.99$ in the other. Finally, notice that while our current method of eliciting choice could be interpreted as the 'strategy method,' it could alternatively be interpreted as a standard fully-incentivized elicitation of choice between a certain outcome and a lottery.

cannot arise in our experiment.

Third, our procedure is explained to subjects at the outset, and so they are never surprised by facing a choice they did not previously realize they might have to make. This feature is absent in past variations of Knetsch's (1989) original experiment, where subjects are first endowed with a good, and only later learn that in fact they can trade it. In other words, subjects in our experiment explicitly learn at the outset the complete probability distributions regarding outcomes, and we have no need to speculate—as, e.g., Knetsch and Wong (2009) do—regarding subjects' expectations. Relatedly, and importantly, we have direct evidence on expectations in subjects' responses to the quiz.

To summarize, our first experiment is, to the best of our knowledge, the first one designed to answer the question: *In the original setup, what is the largest effect that could result from expectations alone?* Hence, rather than demonstrating that KR *could* potentially explain some of the effect (as, e.g., Ericson and Fuster (2010) do), we ask *how much* of the original effect KR in fact explains.

2.3.2 Solving the Model

We now solve the consumer problem faced by subjects. Assume w.l.g. that a subject's default gift, as determined by the coin-flip, is c_1; the alternative gift is c_2. Depending on experimental treatment, the subject can choose her gift with probability $q \in \{0.01, 0.99\}$. Also assume w.l.g. that $m_1(0) = m_2(0) = 0$. If the subject expects to keep c_1, she can do so regardless of the envelope draw. Her reference consumption is then c_1 regardless of q. If she indeed chooses to keep c_1 when asked for her choice later, her reference coincides with her actual consumption, and her utility—expected as well as realized—is just $m_1(c_1)$, with no gain-loss terms. On the other hand, if she deviates from her reference consumption and chooses c_2, her utility will be $m_1(c_1)$ with probability $1-q$ and $m_2(c_2)+\eta m_2(c_2)-\eta\lambda m_1(c_1)$ with probability q. It is thus straightforward to show that given her expectation to keep c_1 (e.g. when answering the quiz), she will indeed choose to keep c_1 (when choice is elicited) as

long as

$$\frac{m_1(c_1)}{m_2(c_2)} \geq \frac{1+\eta}{1+\eta\lambda}. \tag{1}$$

In other words, choosing c_1 is consistent with a PE as long as (1) holds.

Alternatively, the subject may expect (when answering the quiz) to choose c_2 when choice is elicited later. In that case, she expects to consume c_1 with probability $1-q$ and c_2 with probability q. Given such expectations and following a line of reasoning similar to the one above, it can be shown that she will indeed choose c_2 later as long as

$$\frac{m_1(c_1)}{m_2(c_2)} \leq \frac{1+(1-q+q\lambda)\eta}{1+((1-q)\lambda+q)\eta}. \tag{2}$$

Thus, when (2) holds, choosing c_2 is consistent with a PE.

The model's predictions can now be analyzed for any $0 \leq q \leq 1$. However, for our purposes it is sufficient to point out the following approximate results.[8] For q close to 0, there is a unique choice consistent with a PE for $\frac{m_1(c_1)}{m_2(c_2)}$ on either side of $\frac{1+\eta}{1+\eta\lambda}$: if the former ratio is greater than the latter, a subject will choose c_1; if it is smaller, she will choose c_2. As q grows, there is a growing region for $\frac{m_1(c_1)}{m_2(c_2)}$ to the right of $\frac{1+\eta}{1+\eta\lambda}$ where choosing either c_1 or c_2 can be consistent with a PE, and for q close to 1 this region stretches all the way to $\frac{1+\eta\lambda}{1+\eta}$. It can then be shown—by comparing the expected utility associated with one PE with that associated with the other—that for $q \approx 1$ a PPE is only consistent with the subject choosing c_1 if $\frac{m_1(c_1)}{m_2(c_2)} \geq 1$ and c_2 otherwise.

2.3.3 Experiment 1: Predictions

We now summarize the above analysis and compare the predictions of KR with those of the standard neoclassical model. In the $q = 0.01$ (Strong Reference) treatment, subjects expect to consume the default c_1 with very high probability. According to KR, choosing c_2 would

[8]The results we state here are only approximately true in the following sense: they are exactly true for $q = 0$ and for $q = 1$, but become only approximations for q in the vicinity of these extreme values. Replacing these approximations with exact mathematical expressions unnecessarily complicates the presentation while having negligible effect on the relevant empirical predictions.

hence involve a relatively large loss term. For example, if $\eta = 1$ and $\lambda = 3$, subjects are predicted to choose c_1 as long as $m_1(c_1) \geq \frac{1}{2} m_2(c_2)$. This is a rather weak condition as long as subjects perceive the two goods to be of roughly comparable value for them.[9] Under these assumptions, according to KR, the coin-flip should affect choice. On the other hand, for the $q = 0.99$ (Weak Reference) treatment, half the subjects are expected according to KR to choose c_2—the good that was not assigned to them by the coin-flip. Finally, the standard model predicts half the subjects to choose c_2 regardless of treatment.

To summarize: (i) finding no effect of the coin-flip on choice under either treatment is consistent with the standard model. Naturally, it is also consistent with KR if $m_1(c_1)$ and $m_2(c_2)$ are of very different values, if λ is close to 1, or if η is sufficiently small.[10] (ii) Finding the effect for $q = 0.01$ but not for $q = 0.99$ is consistent with KR but cannot be explained by the standard model. (iii) Finding the effect under both treatments would require an explanation—a theory of attachment or a psychology of coin-assignment—that neither KR nor the standard model currently provides. It is of course possible that such an explanation could be combined with either model. In that case, one could refer to the smaller of the two effects as a baseline, subtract it from both effects, and compare the residuals across treatments. A comparison in the spirit of (i) and (ii) above could be informative as to which of the two models seems useful as part of such a combined explanation. For example, if the effect is larger for $q = 0.01$ than for $q = 0.99$, KR might explain some—though not all—of the effect. (iv) Finally, we are aware of no theory that could explain finding an effect for $q = 0.99$ but not for $q = 0.01$ (or, more generally, finding a larger effect for the former treatment than for the latter).

[9] Remember that on average, for half the subjects c_1 is the mug and for the other half it is the pen. They cost roughly the same and, crucially, were chosen to be similar to those used in other endowment effect experiments (where the endowment of one of them had a large effect on choices). Also remember that for KR to apply, the goods have to be for final consumption.

[10] Notice that since KR is more general than the standard model, and reduces to it e.g. with $\eta = 0$, any "test between the two models" is, effectively, a test regarding the sizes of KR's η and λ.

3 Experiment 1: Results

102 subjects participated in our first experiment, which was conducted during September and October 2009. We first describe their replies to the quiz questions, and then we analyze their replies to the choice question.

3.1 Expectations

The quiz page on the experimental instructions includes two questions. Question 1 is reproduced below.

> 1. With 1% probability, the number I wrote down will turn out the same as the number in the envelope. In that case:
>
> (Please check one box. If you check the bottom box, please also fill out the blank space.)
>
> ☐ My gift will be the one I choose, regardless of the coin-flip.
>
> ☐ My gift will be _____, as determined by the coin-flip, regardless of my choice.

Question 2 is identical to question 1 in all but the first two lines, which in question 2 read:

> With 99% probability, the number I wrote down will not turn out the same as the number in the envelope. In that case:

Of our 102 subjects, 94 subjects (92%) answered question 1 correctly in their first attempt. The eight subjects who did not were asked to re-read the instructions and try again. Seven of them answered the question correctly in their second attempt. The experimenter explained the instructions and the quiz questions to the one subject who did not, but we have no evidence that that subject indeed understood the instructions and hence we have no evidence regarding that subject's expectations. In question 2, 100 subjects (98%) answered correctly in their first attempt, and the two subjects who did not also did not answer it correctly in their second attempt. The experimenter then explained to them the instructions and the

quiz. Overall, 94 subjects (92%) answered both questions correctly on their first attempt. It seems reasonable to assume with confidence that these subjects fully understood the instructions, and formed expectations as intended by the experimental design.[11] We present choice results below both for the entire population and for these 94 subjects separately.

3.2 Choice

Table 1 reports results for our entire population of 102 subjects. Its rows follow the structure of Table 1 in Plott and Zeiler (2007). Its leftmost column, titled "All," shows that overall, across the two treatments, subjects' coin-flip affects their choices. The first row shows that 60 subjects' coin-flips assigned them with a mug and 42 subjects' coin-flips assigned them with a pen, and the second row shows that of the former, 48 subjects chose a mug as their gift, while 28 of the latter did so. The respective proportions—80% and 67%—are presented in the third row. Finally, the bottom row reports the result of a two-sample one-sided test of equality of proportions. It shows that the difference (13%) between the proportion of mug choosers among 'coin-mug' vs. 'coin-pen' subjects is statistically significant at the 6% level.

[Table 1 about here.]

The next two columns of Table 1 report results by treatment. They show that the effect of coin-flip on choice cannot be explained by expectations: the difference in proportions in the Strong Reference treatment (8%) is in fact roughly half that in the Weak Reference treatment (17%). Indeed, the rightmost column shows that while in the Strong Reference treatment 3% less coin-pen subjects chose mug than in the Weak Reference treatment, the difference among coin-mug subjects—which according to KR should be negative—is (positive) 12%. As the bottom row shows, none of these latter differences is statistically significant.

Table 2 reports results for the sub-sample of 94 subjects who understood the instructions on first reading, formed expectations as intended, and correctly answered the quiz—our

[11] Notice that psychologically, fully understanding the relevant probabilities may not be equivalent to forming expectations. However, as is standard in economics, KR *define* the latter as the former.

manipulation check—on first attempt. Among these subjects the coin-flip seems to have affected choice more strongly than among the entire population: as seen in the leftmost column, the difference in proportions between coin-mug subjects who chose a mug and coin-pen subjects who chose a mug is 20%, and it is statistically significant at the 1% level. However, the next two columns show that, as in Table 1, the difference in proportions is not larger in the Strong Reference treatment (17%) than in the Weak Reference treatment (19%) and hence cannot be explained by expectations. The rightmost column again shows that while the proportion of mug choosers among coin-pen subjects is larger (8% difference) in the Weak Reference treatment than in the Strong Reference treatment—i.e. it is in the direction predicted by KR—it is also larger (9%) among coin-mug subjects—opposite to KR's prediction.

[Table 2 about here.]

3.3 Interpretation

Our overall reading of Tables 1 and 2 is that while coin-flip seems to affect subjects' choices, assignment to treatment does not. While the former cannot be explained by the standard neoclassical model, combined with the latter it cannot be explained by KR either.[12] Our interpretation of the results from our first experiment is hence that there might be "psychological" effects of the coin-flip on choice, or of the coin-flip combined with our experimental procedures on choice, but we find no evidence that the effects are driven by the coin-flip's effect on expectations.[13]

[12]KR could explain our findings if subjects exhibit a level of probability weighting so extreme that they regard a 1% chance and a 99% chance as roughly equally probable. Naturally, such interpretation would empty KR from much of its empirical content.

[13]One technical concern regarding Tables 1 and 2 is related to the fact that, as seen in the Weak Reference column in either table, twice as many subjects in that treatment were assigned by their coin-flip to the mug as those assigned to the pen. However, we believe that this unbalance reflects natural variation rather than reflecting e.g. that subjects somehow found a way to affect (or to cheat about) their coin-flip. Our conclusion is based on the following observations. First, the experimenter was always present in the vicinity of subjects (although, admittedly, not always directly looking). Second, more importantly, when subjects flip the coin (on the first page of the instructions), they do not know yet which coin-flip outcome would

4 Experiment 2

4.1 Design and Predictions

Our second experiment is designed as an attempt to disentangle our experimental procedures (including the coin-flip) from expectations. Specifically, it is designed to disentangle procedures from expectations regarding a subject's *own outcomes*.[14]

Our second experiment hence essentially replicates our first experiment, but it expands the experimental design to a 2×2 design, and in addition to having Strong Reference vs. Weak Reference treatments, it also turns off ("Group A") and on ("Group B") the link from these treatments (and from coin-flips) to expectations regarding own outcomes. This is done by assigning half the subjects (in both the Strong and Weak Reference treatments) into Group A and the other half into Group B, and by explicitly informing all subjects that while everybody is asked to read and understand the complete set of instructions (and answer all quiz questions), much of the instructions will not apply to Group A subjects who, regardless of their coin-flip, will get to choose their gift with certainty.

Specifically, on the second page of the instructions, subjects are told:

> Each participant in the room is either in Group A or in Group B. Your group is indicated at the top left of page 1 of the instructions. ...

assign them to which item. Third, and most importantly, unbalanced coin-flips are only found in the Weak Reference treatment, where the coin-flip has virtually no effect on subjects' choice set (it could limit their choice set with only 1% probability) and, according to both the neoclassical model and KR, should have virtually no effect on outcomes. Reassuringly, in the Strong Reference treatment, where the coin-flip strongly affects subjects' outcomes (by simply eliminating choice and determining their gift with 99% probability), the coin-flips came out perfectly balanced.

[14] In doing so, our second experiment also addresses the following conceptual point. Consider any experiment that compares subjects assigned to an "expectations x regarding own outcomes" treatment with those assigned to an "expectations y regarding own outcomes" treatment (in our case, Strong Reference vs. Weak Reference). Such an experiment effectively keeps constant across treatments the very fact of linking treatments with "expectations regarding own outcomes" (as opposed to linking them with something else). As a result, rather than *testing* it, such an experiment effectively *assumes* that it is this specific form of expectations—indeed, that it is some form expectations in the first place—that is crucial in determining the results.

While being a subtle point, potentially of only limited empirical importance, this point applies more generally to many other past experiments and is independent of our specific findings in our first experiment above.

> The instructions include sections that are common to all participants, and sections that apply only to Group A participants or only to Group B participants. ...
>
> We ask that regardless of your group, you carefully read and understand all sections of the instructions ... without skipping any parts of the text. ... In other words, we ask you to read and understand the complete set of instructions, but remember that sections that apply to the other group will not affect you in any way. (It is important for the study that both groups read the same set of instructions.)

For an example of the full instructions (as well as a photo of the experimental setup) see Appendix B.[15] While the instructions are longer than in our first experiment, and are more complicated for subjects to understand, we show below that three quarters of subjects fully understood them on first reading and answered all quiz questions correctly on their first attempt.

In this 2 {Strong Reference vs. Weak Reference} $\times$ 2 {Group A vs. Group B} design experiment, the standard neoclassical model still predicts no effect on choice of either the coin-flip or assignment into one of the four experimental cells. On the other hand, KR (with η sufficiently greater than 0, λ sufficiently greater than 1, and $m_1(c_1)$ sufficiently close to $m_2(c_2)$) predicts that coin-flips should matter in Strong Reference cells more than in Weak Reference cells, and—crucially for the "expectations regarding own outcomes" interpretation—in Group B more than in Group A.

4.2 Expectations

Our second experiment was conducted between November 2009 and April 2010 at a large university in the Northeast. 434 subjects participated. The quiz, which is identical across

[15] As is clear from reading the instructions and viewing the setup photo, our second experiment differs from our first experiment in technical implementation details that are orthogonal to the theories tested. Such details include location, the exact design of the mug and the pen, the time-filler survey (in the second experiment it is a one-page "Big Five" personality traits questionnaire (John and Srivastava, 1999) embedded in the instructions), and that in the second experiment the experimenter flips the coin (in the presence of the subject; see footnote 13).

subjects and which all subjects have to fully answer regardless of assignment, consists of four questions (see Appendix B). In addition to the two quiz questions from Experiment 1, which in Experiment 2 are questions about Group B subjects, the quiz in Experiment 2 also adds a question about Group A subjects, and another question to verify that each subject fully understands which group she is in and hence forms expectations regarding her own outcomes as intended by the experiment.

Subjects responded to the four questions as follows. 424 subjects (98%) answered the Group A question correctly on first attempt, and the other ten answered it correctly on second attempt. Subjects found the two Group B questions harder to answer, with 345 and 378 of them (79% and 87%), respectively, answering on first attempt the "1% probability" and the "99% probability" questions. On second attempt, 63 and 36 additional subjects answered these two questions correctly, while the reminder 26 and 20 subjects did not. Finally, 409 subjects (94%) answered correctly on first attempt the fourth question—which verifies that subjects formed expectations about their own consumption as intended; and of the reminder 25, eleven answered it correctly on second attempt.

Overall, 326 subjects (75%) answered all four questions correctly on first attempt. One can be rather confident that in spite of the complexity of the design, these subjects fully understood the instructions on first reading and formed expectations as intended by the experiment.

4.3 Choice

Tables 3 and 4 present choice results in Experiment 2, by coin-flip and by experimental condition. Each of the top two panels in each table—titled "Group A" and "Group B"—has identical structure to Tables 1 and 2. An additional panel at the bottom—titled "Difference"—compares results in Group A with those in Group B. In contrast with Tables 1 and 2, which present results from one-sided equality-of-proportions tests, all "Result" rows in Tables 3 and 4 present results from two-sample *two*-sided tests, effectively treating results

in either direction symmetrically.[16]

[Table 3 about here.]

[Table 4 about here.]

Our overall summary of Tables 3 and 4 is that in Experiment 2 we find no strong evidence that either coin-flip or expectations matter much, among either the entire set of 434 subjects or among the 326 subjects who fully understood the instructions on first reading and formed expectations as intended by the different experimental conditions. Moreover, the sign of the (statistically weak) differences between conditions often go in a direction opposite to KR's predictions. While this general conclusion is reflected in many of the outcomes reported in the tables, we highlight below three specific points.

We first look at the leftmost column in either table. In neither the Group A nor Group B panels can we reject equality of the proportion of mug choosers among coin-mug vs. coin-pen subjects. Indeed, in Group B *more* coin-pen subjects chose mug than coin-mug subjects (the difference in proportions is -2% in Table 3 and -7% in Table 4, compared with 2% and 4%, respectively, in Group A), opposite to KR's prediction.[17]

Second, focusing on the Strong Reference column, in neither of the panels and in neither of the tables do more coin-mug subjects choose mug than coin-pen subjects (results vary more in the Weak Reference column). This result again cannot be explained by a lack of statistical power; indeed, in each of the two Strong Reference cells in each of the two tables,

[16]For one-sided tests (in the direction of the results) the reader should divide the reported p-values by two. Importantly, in interpreting the results one should bear in mind that together, Tables 3 and 4 report 32 p-values. While these p-values are not independent of each other, the probability of getting by chance a low p-value in any of the tests is substantially higher than that suggested by any individual p-value.

[17]As seen in the Difference panel, a two-sided test can almost reject equality of the proportion of mug choosers among coin-pen subjects between Group A and Group B (62% and 74% in the leftmost column of Table 4; see also the Strong Reference column). Rejecting the null here would suggest that coin-pen subjects in Group B—where coin-flip affects expectations regarding own outcomes—are *less* likely to choose in line with their coin-flip than Group A subjects—where coin-flip affects expectations regarding the outcomes of others in the room but not of the subject herself. Such a finding would go in the opposite direction of KR's prediction (and, naturally, would not be explainable by the standard neoclassical model). Investigating whether yet-to-be-modeled social comparison effects might be at work here is left for future work. Notice however that among coin-mug subjects we find no such result (and remember that among coin-pen subjects the result is statistically weak).

the small (and never statistically significant) difference in proportions is *negative*. In Group B—where the coin-flip affects expectations regarding own outcomes—this negative difference in proportions is -7% and -8% (in Tables 3 and 4, respectively), compared with -1% and -2% in Group A. This, again, is opposite to the direction of KR's prediction.

Finally, the rightmost column in either table shows that the difference among Group B subjects between the proportion of mug choosers in the Strong Reference vs. the Weak Reference treatments is in the direction predicted by KR among coin-mug subjects, but in the opposite direction among coin-pen subjects. None of these differences is more than marginally statistically significant.

5 Discussion and Conclusion

The two experiments reported in this paper replace endowment with expectations and fail to replicate anything close to Knetsch's (1989) original endowment effect. While our experiments are not the first to find a dramatically diminished effect once controlling for potential confounds in the original experiment, they are the first to do so while carefully establishing, and verifying with a quiz, subjects' expectations regarding outcomes. Specifically, most of our subjects show that they know the exact probabilities with which they are likely to leave the lab owning a mug or a pen. And yet, we find no evidence that the difference between expecting to own an item with 99% probability and expecting to own it with 1% probability (or even with 0% in Experiment 2) matters.

In other words, our experiments fail to find a KR-esque link from expectations regarding consumption to choices. One potential explanation why Ericson and Fuster (2010) do find evidence for such a link relates to the psychological mechanism that may underlie the link. Ericson and Fuster mention the possibility of a mechanism running from a subject's expectations to own an item with high probability to the subject spending time thinking about the item, which in turn affects the subject's reference point. Consistent with such

interpretation, they report that compared with subjects who were endowed with a mug and expected with high probability to be able to trade it later for a pen, subjects who expected a later trade option with low probability "more strongly agree" that they spent more time thinking about the mug than about the pen. In the same vein, and consistent with our findings, it is certainly possible that in our Experiment 1 subjects spent more time thinking about the item assigned to them by the coin-flip, regardless of the probability with which the assignment would affect their choice set. It is also possible that in our Experiment 2 subjects in both Group A and Group B spent much time thinking about "what could have happened" or "what happens to others" or "what the universe of possibilities is" or "what should have happened to me if the experiment were fair" etc. In short, if expectations affect outcomes due to the time spent thinking about the outcomes, then the implementation details of how expectations are controlled in each specific experiment might be what drives both our and others' findings. In that case, experiments that are viewed as tests of KR could in reality be testing special cases of "time spent thinking" theories.

A potential concern regarding our design is that a 1%-probability event may be perceived by subjects as so unlikely to occur that they do not choose carefully or, conversely, may be perceived as looming much larger than its true probability. While concerns of this nature indeed serve as motivation for further exploration and replication, we note that none of them can easily explain our findings.

While we intuitively believe that expectations regarding outcomes matter for consumer choices in many contexts, we fail to find supporting evidence in the context of the endowment effect. We close the paper by suggesting directions for future research. One such direction would be to explore the timing of the establishment of expectations. As KR repeatedly note, their model is silent on what the "recent past" in which expectations were formed or held is. Another direction would be to gain better understanding of what are the objects that go into one's vector of consumption utility components ($\mathbf{m}(\mathbf{c})$ in either KR or the neo-classical model, and therefore also $\mathbf{m}(\mathbf{r})$ in KR). In the process of disentangling instructions

about probabilities from expectations regarding own outcomes, our second experiment might have unintentionally also added a social component, by drawing subjects' attention to the potential outcomes of others in the room. Future KR-motivated experimental work could incorporate a social component into the models it tests.

Finally, we believe that future work—both theoretical and experimental—should think carefully about the source and nature of expectations. While in economists' models expectations are often equivalent to beliefs about probability distributions, one might wonder whether expectations exogenously dictated in the lab affect choices in the same way that naturally occurring expectations do; whether expectations have different effects when they are perceived as, e.g., unfair; or whether (and how) aspirations and expectations interact.

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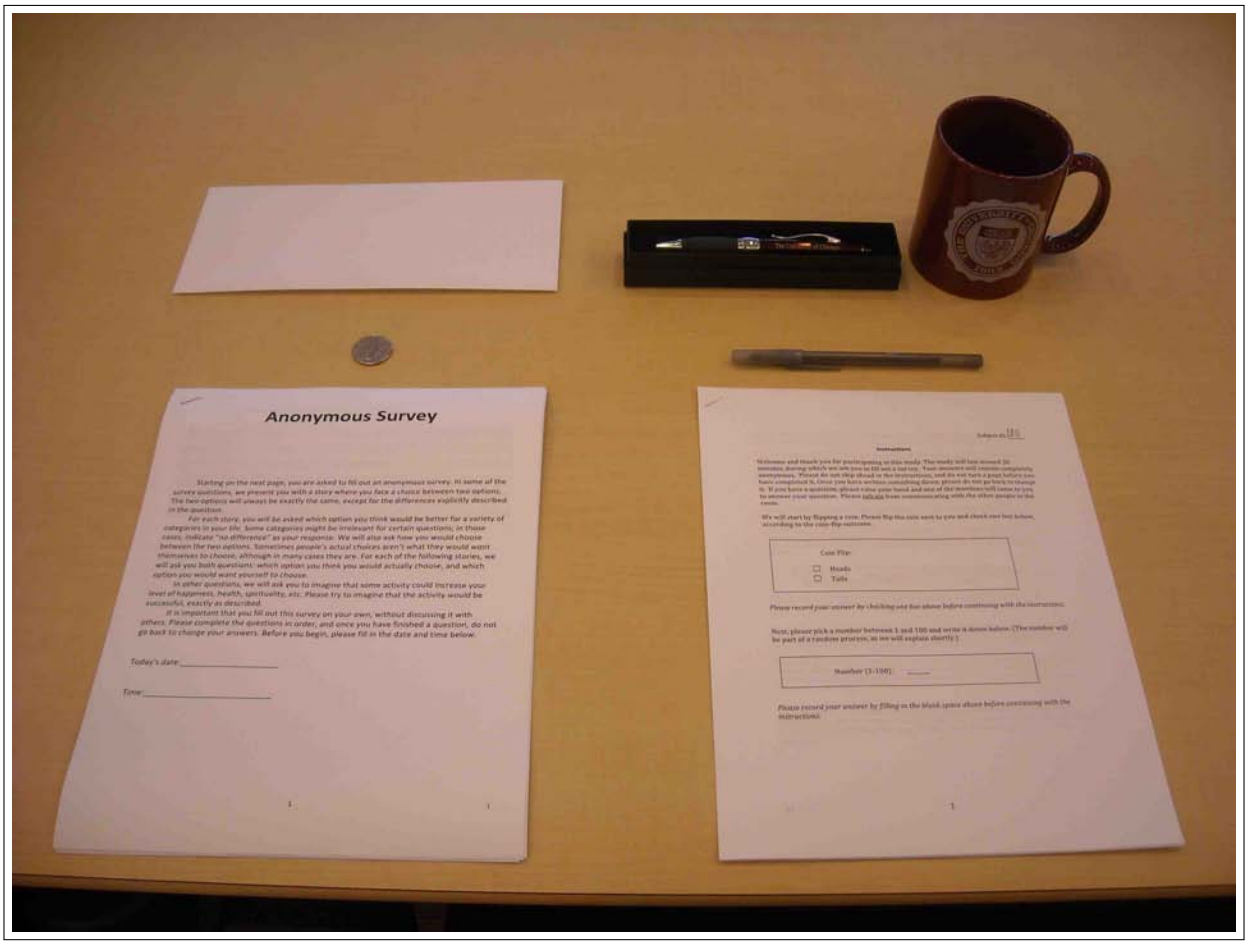
Appendix A: Experiment 1 Instruments Example



[Instructions start on the next page.]

Subject ID: _____

Instructions

Welcome and thank you for participating in this study. The study will last around 30 minutes, during which we ask you to fill out a survey. Your answers will remain completely anonymous. Please do not skip ahead in the instructions, and do not turn a page before you have completed it. Once you have written something down, please do not go back to change it. If you have a question, please raise your hand and one of the monitors will come to you to answer your question. Please refrain from communicating with the other people in the room.

We will start by flipping a coin. Please flip the coin next to you and check one box below, according to the coin-flip outcome.

Coin Flip:

☐ Heads
☐ Tails

Please record your answer by checking one box above before continuing with the instructions.

Next, please pick a number between 1 and 100 and write it down below. (The number will be part of a random process, as we will explain shortly.)

Number (1-100): _____

Please record your answer by filling in the blank space above before continuing with the instructions.

In front of you are two items. You will get one of them as a gift to take home. Whether or not you can choose your gift is determined at random, as explained below in detail.

In brief, there is a 1% probability that you will be able to choose which item you take home. However, there is a 99% probability that you will NOT be able to choose, and that your gift will automatically be the pen if you flipped "heads" and automatically be the mug if you flipped "tails."

Feel free to inspect the items but please return them both to their places before we continue.

Please inspect the items but set them back before continuing with the instructions.

You will begin a survey shortly, but first you will learn how it will be decided which gift you take home. When you are finished with the survey, before you go home with your gift, the outcome of a random process will determine if you can choose it. This process will be as follows:

1) We will ask you which of the two items you want as your gift.
2) We will ask you to open the sealed envelope next to you. The envelope contains a randomly-selected number between 1 and 100 inside.

If the number you wrote down in the previous page is the same as the number in the envelope, your gift will be the item you have just chosen, regardless of your previous coin-flip.

If the number you wrote down in the previous page is NOT the same as the number in the envelope, your gift will be determined from the coin flip: your gift will automatically be the pen if you flipped "heads" and automatically be the mug if you flipped "tails."

Notice that you have a 1% chance (or 1/100) to be able to choose your gift at the end of the survey. In other words, there is a very high probability that you will take home the gift determined by the coin-flip, regardless of which gift you choose. If you have any questions, please raise your hand.

You will now answer two comprehension questions to make sure that you understand exactly how the gift you receive at the end of the study will be determined. After answering the questions you will begin the survey. Please turn to the next page to answer these questions.

Please answer the following two questions.

1. With 1% probability, the number I wrote down will turn out the same as the number in the envelope. In that case:

(Please check one box. If you check the bottom box, please also fill out the blank space.)

☐ My gift will be the one I choose, regardless of the coin-flip.

☐ My gift will be _____, as determined by the coin-flip, regardless of my choice.

2. With 99% probability, the number I wrote down will not turn out the same as the number in the envelope. In that case:

(Please check one box. If you check the bottom box, please also fill out the blank space.)

☐ My gift will be the one I choose, regardless of the coin-flip.

☐ My gift will be _____, as determined by the coin-flip, regardless of my choice.

Please raise your hand when you finish.

You are now going to take a survey. The questions on the survey are hypothetical and you are asked to imagine yourself in different situations. Please try to answer the questions as accurately as you can.

Before continuing, please complete the Anonymous Survey found on your desk.

After completing the Anonymous Survey, please proceed to the next page of instructions.

You will shortly find out the outcome of the random process that determines whether or not you choose your gift.

Please indicate which gift, the pen or the mug, you would like to receive regardless of the item that would be assigned to you by the coin flip. In other words, choose the item you want, which may or may not be the same as the item you would get based on the coin flip in the beginning.

My choice: _____

Please wait until everyone has filled in the blank space with a choice (pen or mug) and the monitor has instructed you to continue.

Before opening your envelope, please answer the next two questions. The questions are hypothetical so you are not required to purchase anything and your answers will not affect you in any way. But please answer truthfully, as if you were going to fulfill the purchase decisions. When answering, please ignore the fact that you will soon own one of the two items in front of you.

1. **Pen:** What would be the maximum price that you would be willing to pay to purchase a pen like the one in front of you?

I would be willing to pay up to $_____ to purchase a similar pen.

2. **Mug:** What would be the maximum price that you would be willing to pay to purchase a mug like the one in front of you?

I would be willing to pay up to $_____ to purchase a similar mug.

After you have answered the two questions above, please open your envelope.

If the number you wrote down is the same as the number in the envelope, your gift will be the item you have just chosen, regardless of the coin flip in the beginning.

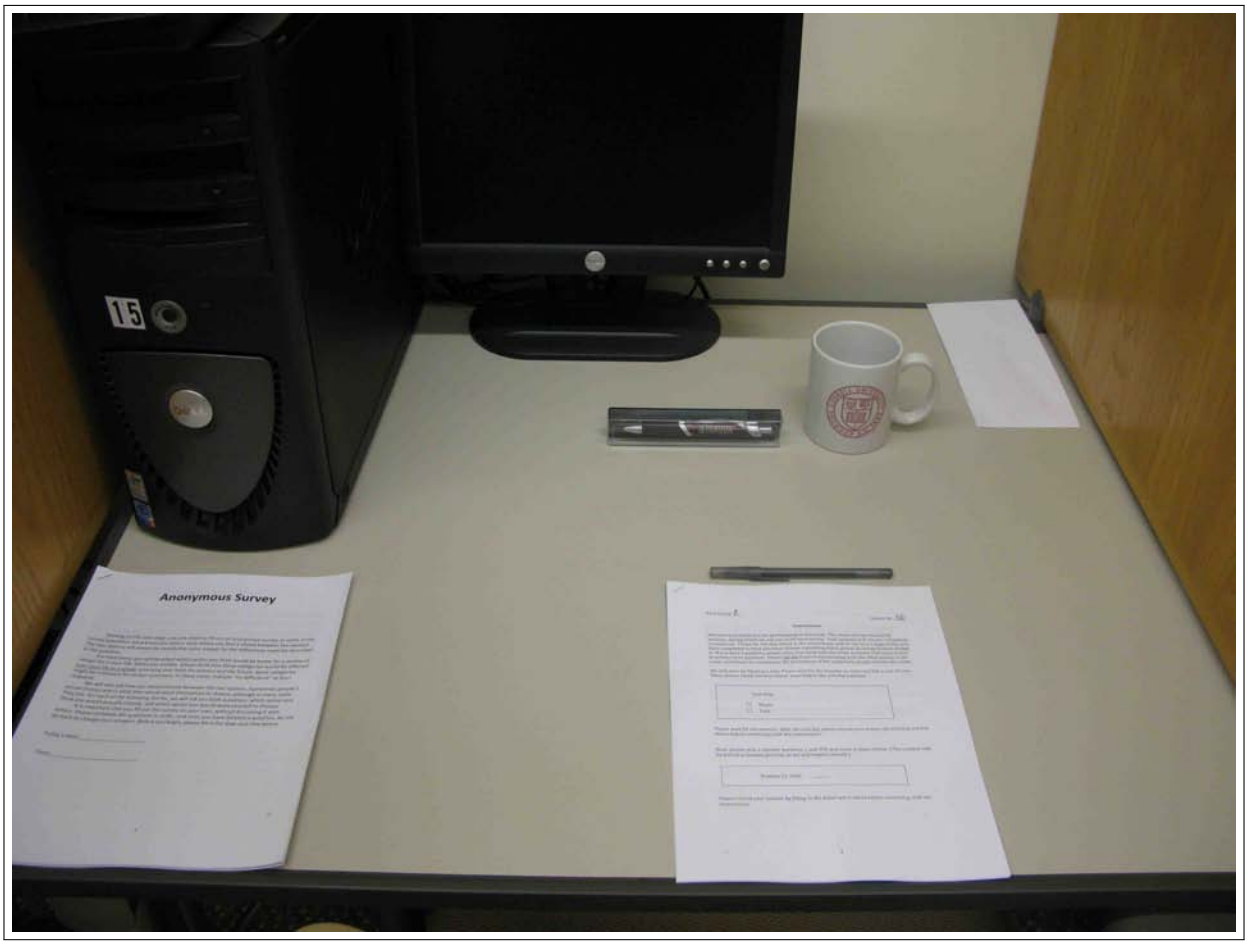
If the number you wrote down is NOT the same as the number in the envelope, your gift will be the one determined by the coin flip in the beginning.

Are there any questions?

The monitors will now come by and distribute your gifts. You are free to leave once you have received your gift.

Thank you for participating. If you have any comments or thoughts you would like to share with us, please write them on the lines below. We are also curious to know: how did you decide which gift to choose?

Appendix B: Experiment 2 Instruments Example



[Instructions start on the next page.]

Your Group: _____

Subject ID: _____

Instructions

Welcome and thank you for participating in this study. The study will last around 45 minutes, during which we ask you to fill out a survey. Your answers will remain completely anonymous. Please do not skip ahead in the instructions, and do not turn a page before you have completed it. Once you have written something down, please do not go back to change it. If you have a question, please raise your hand and one of the monitors will come to you to answer your question. Please refrain from communicating with the other people in the room, and please do not discuss the procedures of the study with people outside this room.

We will start by flipping a coin. Please wait for the monitor to come and flip a coin for you. Then, please check one box below, according to the coin flip outcome.

Coin Flip:

☐ Heads
☐ Tails

Please wait for the monitor. After the coin flip, please record your answer by checking one box above before continuing with the instructions.

Next, please pick a number between 1 and 100 and write it down below. (The number will be part of a random process, as we will explain shortly.)

Number (1-100): _____

Please record your answer by filling in the blank space above before continuing with the instructions.

Your Group: ____ (*Please copy your group (A or B) from the top of page 1.)*

Each participant in the room is either in Group A or in Group B. Your group is indicated at the top left of page 1 of the instructions. Each time you start reading a new page of the instructions, we ask that you first copy your group letter (A or B) from page 1 into the blank space ("Your Group: ____") at the top of the page you are reading.

The instructions include sections that are common to all participants, and sections that apply only to Group A participants or only to Group B participants. The sections that apply to all participants, like the section you are reading now, appear in normal type. The sections that apply only to Group A participants appear in red type. The sections that apply only to Group B participants appear in blue type.

We ask that regardless of your group, you carefully read and understand all sections of the instructions (including all red and blue sections), without skipping any parts of the text. However, the sections that do not apply to your group will not apply to you. In other words, we ask you to read and understand the complete set of instructions, but remember that sections that apply to the other group will not affect you in any way. (It is important for the study that both groups read the same set of instructions.)

To make sure you understand all sections of the instructions, including the sections that will not apply to you, you will be asked to answer comprehension questions about both the red and the blue sections as we go along.

Please raise your hand and wait until the monitor instructs you to continue.

Please do not proceed until the monitor has asked you to continue.

Your Group: ____ (*Please copy your group (A or B) from the top of page 1.)*

In front of you are two items. They were purchased from the bookstore, and cost roughly the same. At the end of the study today, you will get one of them as a gift to take home.

Group A only: you will get to choose your gift.

Group B only: whether or not you will get to choose your gift is determined at random, as explained below in detail.

In brief, there is a 1% probability that you will be able to choose which item you take home. However, there is a 99% probability that you will NOT be able to choose, and that your gift will automatically be the pen if you got "heads" and automatically be the mug if you got "tails" by the coin flip.

Feel free to inspect the items but please return them both to their places before we continue.

Please inspect the items but set them back before continuing with the instructions.

Group A only: you will answer a list of questions shortly, and when you finish you can choose your gift.

Group B only: you will answer a list of questions shortly, but first you will learn how it will be decided which gift you take home. When you are finished with the questions, the outcome of a random process will determine if you can choose your gift. This process will be as follows:

1) We will ask you which of the two items you want as your gift.
2) We will ask you to open the sealed envelope next to you. The envelope contains a randomly-selected number between 1 and 100 inside.

If the number you wrote down on page 1 is the same as the number in the envelope, your gift will be the item you have just chosen, regardless of the previous coin flip.

If the number you wrote down on page 1 is NOT the same as the number in the envelope, your gift will be determined from the coin flip: your gift will automatically be the pen if you got "heads" and automatically be the mug if you got "tails."

Notice that you have a 1% chance (or 1/100) to be able to choose your gift after answering the list of questions. In other words, there is a very high probability that you will take home the gift determined by the coin flip, regardless of which gift you choose. If you have any questions, please raise your hand.

Your Group: ____ (*Please copy your group (A or B) from the top of page 1.)*

To make sure that you understand how the gift participants receive at the end of the study will be determined, please answer the following questions. Please answer both red and blue questions, but remember that only questions about your group will apply to you.

Group A only: neither the number I wrote down nor the number in the envelope will affect me in any way. In any case:

(Please check one box. If you check the bottom box, please also fill out the blank space.)

☐ My gift will be the one I choose, regardless of the coin flip.

☐ My gift will be _____, as determined by the coin flip, regardless of my choice.

Group B only: with 1% probability, the number I wrote down will turn out the same as the number in the envelope. In that case:

(Please check one box. If you check the bottom box, please also fill out the blank space.)

☐ My gift will be the one I choose, regardless of the coin flip.

☐ My gift will be _____, as determined by the coin flip, regardless of my choice.

With 99% probability, the number I wrote down will not turn out the same as the number in the envelope. In that case:

(Please check one box. If you check the bottom box, please also fill out the blank space.)

☐ My gift will be the one I choose, regardless of the coin flip.

☐ My gift will be _____, as determined by the coin flip, regardless of my choice.

Your Group: _____ (*Please copy your group (A or B) from the top of page 1.)*

Next, please answer the following question. Notice that this question asks you about how your gift will actually be determined, given your actual group as indicated at the top of the page.

Given my group, the gift I receive at the end of the study will be determined as follows:

(Please check one box. If you check the bottom box, please also fill out the blank spaces.)

☐ My gift will be the one I choose, regardless of the coin flip.

☐ My gift will be the one I choose with a ___% chance. However, it will be _____, as determined by the coin flip, with a ___% chance.

Please raise your hand when you finish.

Please do not proceed until the monitor has verified your answers to the questions above.

Once the monitor asks you to proceed, please proceed to the next page, where we ask you questions about characteristics that may or may not apply to you. When you finish these questions, you will proceed to choose your gift.

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
1	2	3	4	5

I see Myself as Someone Who…

___1. Is talkative

___2. Tends to find fault with others

___3. Does a thorough job

___4. Is depressed, blue

___5. Is original, comes up with new ideas

___6. Is reserved

___7. Is helpful and unselfish with others

___8. Can be somewhat careless

___9. Is relaxed, handles stress well

___10. Is curious about many different things

___11. Is full of energy

___12. Starts quarrels with others

___13. Is a reliable worker

___14. Can be tense

___15. Is ingenious, a deep thinker

___16. Generates a lot of enthusiasm

___17. Has a forgiving nature

___18. Tends to be disorganized

___19. Worries a lot

___20. Has an active imagination

___21. Tends to be quiet

___22. Is generally trusting

___23. Tends to be lazy

___24. Is emotionally stable, not easily upset

___25. Is inventive

___26. Has an assertive personality

___27. Can be cold and aloof

___28. Perseveres until the task is finished

___29. Can be moody

___30. Values artistic, aesthetic experiences

___31. Is sometimes shy, inhibited

___32. Is considerate and kind to almost everyone

___33. Does things efficiently

___34. Remains calm in tense situations

___35. Prefers work that is routine

___36. Is outgoing, sociable

___37. Is sometimes rude to others

___38. Makes plans and follows through with them

___39. Gets nervous easily

___40. Likes to reflect, play with ideas

___41. Has few artistic interests

___42. Likes to cooperate with others

___43. Is easily distracted

___44. Is sophisticated in art, music, or literature

Please check: Did you write a number in front of each statement?

Your Group: ____ (*Please copy your group (A or B) from the top of page 1.)*

Group A only: please choose which gift, the pen or the mug, you would like to receive.

Group B only: you will shortly find out the outcome of the random process that determines whether or not you choose your gift.

Please choose which gift, the pen or the mug, you would like to receive regardless of the item that would be assigned to you by the coin flip. In other words, choose the item you want, which may or may not be the same as the item you would get based on the coin flip in the beginning.

Notice: please think carefully about your choice before indicating it. You will not be able to change your mind later.

My choice: _____

Please wait until everyone has filled in the blank space with a choice (pen or mug) and the monitor has instructed you to continue.

Your Group: ____ (*Please copy your group (A or B) from the top of page 1.)*

Before continuing, please answer the next two questions. The questions are hypothetical so you are not required to purchase anything and your answers will not affect you in any way. But please answer truthfully, as if you were going to fulfill the purchase decisions. When answering, please ignore the fact that you will soon own one of the two items in front of you.

1. **Pen:** What would be the maximum price that you would be willing to pay to purchase a pen like the one in front of you?

I would be willing to pay up to $_____ to purchase a similar pen.

2. **Mug:** What would be the maximum price that you would be willing to pay to purchase a mug like the one in front of you?

I would be willing to pay up to $_____ to purchase a similar mug.

Group A only: you do not have to open your envelope. Your gift will be the item you chose.

Group B only: after you have answered the two questions above, please open your envelope.

If the number you wrote down is the same as the number in the envelope, your gift will be the item you chose. If the number you wrote down is NOT the same as the number in the envelope, your gift will be the one determined by the coin flip in the beginning.

The monitor will now come by and distribute your gifts. In the meantime, you are going to take a survey. The questions on the survey are hypothetical and you are asked to imagine yourself in different situations. Please try to answer the questions as accurately as you can.

Please complete the Anonymous Survey found on your desk.

After completing the Anonymous Survey, please proceed to the next page of instructions.

You are free to leave once you have received your gift and everyone completed the survey.

Thank you for participating! If you have any comments or thoughts you would like to share with us, please write them on the lines below. We are especially curious to know: how did you decide which gift to choose?

Table 1: Choice by Coin-flip in Experiment 1 (All 102 Subjects)

	All	Weak Reference ($q = 99\%$)	Strong Reference ($q = 1\%$)	Difference Weak − Strong
(# coin-mug, # coin-pen)	(60, 42)	(34, 16)	(26, 26)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(48, 28)	(29, 11)	(19, 17)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(80%, 67%) diff = 13%	(85%, 69%) diff = 17%	(73%, 65%) diff = 8%	(12%, 3%)
Result	$p = 0.06$	$p = 0.09$	$p = 0.27$	$p = 0.88$, $p = 0.41$

Notes: All p-values are from two-sample one-sided tests of equality of proportions.

Table 2: Choice by Coin-flip in Experiment 1 (Only 94 Subjects Correct on First Attempt)

	All Correct	Weak Reference ($q = 99\%$)	Strong Reference ($q = 1\%$)	Difference Weak − Strong
(# coin-mug, # coin-pen)	(55, 39)	(32, 16)	(23, 23)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(46, 25)	(28, 11)	(18, 14)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(84%, 64%) diff = 20%	(87%, 69%) diff = 19%	(78%, 61%) diff = 17%	(9%, 8%)
Result	$p = 0.01$	$p = 0.06$	$p = 0.10$	$p = 0.82$, $p = 0.31$

Notes: All p-values are from two-sample one-sided tests of equality of proportions.

Table 3: Choice by Coin-flip in Experiment 2 (All 434 Subjects)

	All	Weak Reference ($q = 99\%$)	Strong Reference ($q = 1\%$)	Difference (Weak − Strong)
Group A: Reference applies to some people in the room, but NOT to self				
(# coin-mug, # coin-pen)	(111, 106)	(57, 50)	(54, 56)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(71, 66)	(36, 29)	(35, 37)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(64%, 62%) diff = 2%	(63%, 58%) diff = 5%	(65%, 66%) diff = −1%	(−2%, −8%)
Result	$p = 0.80$	$p = 0.59$	$p = 0.89$	$p = 0.86$, $p = 0.39$
Group B: Reference applies to some people in the room, INCLUDING self				
(# coin-mug, # coin-pen)	(115, 102)	(54, 54)	(61, 48)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(79, 72)	(35, 34)	(44, 38)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(69%, 71%) diff = −2%	(65%, 63%) diff = 2%	(72%, 79%) diff = −7%	(−7%, −16%)
Result	$p = 0.76$	$p = 0.84$	$p = 0.40$	$p = 0.40$, $p = 0.07$
Difference (Group A − Group B)				
	(−5%, −8%)	(−2%, −5%)	(−7%, −13%)	
Result	$p = 0.45$, $p = 0.20$	$p = 0.86$, $p = 0.60$	$p = 0.40$, $p = 0.14$	

Notes: All p-values are from two-sample two-sided tests of equality of proportions.

Table 4: Choice by Coin-flip in Experiment 2 (Only 326 Subjects Correct on First Attempt)

	All Correct	Weak Reference ($q = 99\%$)	Strong Reference ($q = 1\%$)	Difference (Weak − Strong)
Group A: Reference applies to some people in the room, but NOT to self				
(# coin-mug, # coin-pen)	(78, 76)	(38, 37)	(40, 39)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(51, 47)	(25, 21)	(26, 26)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(65%, 62%) diff = 4%	(66%, 57%) diff = 9%	(65%, 67%) diff = −2%	(1%, −10%)
Result	$p = 0.65$	$p = 0.42$	$p = 0.88$	$p = 0.94$, $p = 0.37$
Group B: Reference applies to some people in the room, INCLUDING self				
(# coin-mug, # coin-pen)	(92, 80)	(42, 45)	(50, 35)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(61, 59)	(25, 31)	(36, 28)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(66%, 74%) diff = −7%	(60%, 69%) diff = −9%	(72%, 80%) diff = −8%	(−12%, −11%)
Result	$p = 0.29$	$p = 0.36$	$p = 0.40$	$p = 0.21$, $p = 0.26$
Difference (Group A − Group B)				
Result	(−1%, −12%) $p = 0.90$, $p = 0.11$	(6%, −12%) $p = 0.56$, $p = 0.26$	(−7%, −13%) $p = 0.48$, $p = 0.20$	

Notes: All p-values are from two-sample two-sided tests of equality of proportions.