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Assignment, Expectations, and Endowment: Variations in the Lab and Their Effects on Choice*

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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 a 2×2 experiment that disentangles "assignment" to a good (a mug vs. a pen) from the probability with which an assigned good is expected to be owned. We further vary, with a 2×2×2 experiment, explicit and implicit references to ownership, thus separately varying assignment, expectations, and endowment. While mere assignment can reproduce some of the original effect, we find no role in the effect to expectations.

KEYWORDS: endowment effect, expectations, prospect theory, experiments

JEL CLASSIFICATION: C9, D11, Q26.

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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 has been interpreted differently by different observers, and the search for a theory to organize it has generated much controversy.[2] A recent candidate theory whose potential is increasingly recognized is Kőszegi and Rabin's (2006) (henceforth KR) model of expectations-based reference-dependent preferences. The goal of our paper is to report evidence from two lab experiments aimed at assessing to what extent KR's model can explain Knetsch's (1989) findings.

In KR's model—which builds on, extends, and generalizes ideas from Kahneman and Tversky's prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991)—individuals evaluate economic outcomes not only by considering the outcomes themselves but also by comparing them with a reference point, weighing losses relative to the reference point more heavily than gains.[3] Importantly, KR combine the model with a theory of reference points that are determined by expectations: "a person's reference point is the probabilistic beliefs she held in the recent past about outcomes." The resulting expectations-based model holds promise to explain both the finding of the original effect (along with its

[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] For a flavor of some interpretations and arguments, see e.g. the first few paragraphs in each of the papers cited above.

[3] 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 are not part of the KR model considered in this paper.

many replications) *and* the finding that the effect shrinks or disappears in some experimental environments. For example, under the auxiliary assumption that subjects expect to keep an endowed object *unless* the specific environment (e.g., certain experimental procedures, or subjects' past experience as traders) leads them to expect otherwise, KR's model is consistent with all past evidence that we are aware of.[4] An important feature of our experiments is that we directly manipulate expectations, disentangled from endowment. This permits a clean test of the model without making auxiliary assumptions regarding the environment-dependent link between endowment and expectations.

Our first experiment has a 2×2 design, which consists of two "assignment" conditions (Coin-Mug vs. Coin-Pen) and two "expectations" conditions (Weak Expectations vs. Strong Expectations). 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 expectations condition. In our Weak Expectations treatment, subjects will receive the assigned item with 1% probability, and with 99% probability they will be able to choose one of the two items. In our Strong Expectations treatment, these probabilities are reversed: subjects receive the assigned object with 99% probability, and with 1% probability they choose.

Our 2×2 design allows us to compare the effect on choice of mere assignment to an object with the effect on choice of expecting with near certainty to own the assigned object at the end of the experiment. This amounts to comparing an effect that might be part of Knetsch's (1989) original effect but *cannot* be explained by KR, with an effect that might be part of the original effect and *can* be explained by KR. Moreover, since KR is more general than the standard neoclassical model (and, with certain parameter values, reduces to it), the former effect is predicted by neither KR nor the standard model, while the latter is predicted by

[4]Indeed, Knetsch and Wong (2009) explicitly make a variant of this auxiliary assumption, and conduct experiments that assess KR under this assumption. Specifically, they hypothesize that the endowment effect is triggered by endowment and ownership only in contexts 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).

KR but not by the standard model. Below we refer to the former as a "non-economic" effect—simply because we are not aware of any economic model that predicts it (yet); and to the latter as an "economic" effect. To the best of our knowledge, our experiment is the first to compare the two.[5]

To the extent that endowment in past experiments affected outcomes through establishing expectations (regarding outcomes), assignment in our experiment should affect choice more in the Strong Expectations treatment than in the Weak Expectations treatment.[6] However, while we find that assignment affects choice—subjects are more likely to choose an item when it is assigned to them by the coin-flip than when it is not (on average by 13 to 20 percentage points)—we find no evidence that the effect is larger in the Strong than in the Weak Expectations treatment. Our findings are hence new in two ways. First, we are the first to demonstrate the existence of non-economic effects not only in the absence of past confounds (e.g., those discussed by Plott and Zeiler, 2007) but, importantly, with expectations fully controlled. Second, we are the first to demonstrate the possibility that economic effects are entirely absent in spite of a variation in (verified) expectations that covers close to the entire possible range of expectations.

This second finding—the absence of a KR-esque effect—stands in stark contrast with a closely related experiment (Ericson and Fuster, 2010) (henceforth EF) that was conducted contemporaneously with, and independently of, our experiment. While EF's experiment has no assignment treatments—the authors simply endow 45 subjects with a mug—it has two expectations treatments that are somewhat similar to ours: a coin-flip determines the

[5]Since the non-economic effect of assignment may be smaller than that of endowment—assignment is a weaker condition than endowment and implies ownership only implicitly—our assignment treatment may capture part, but not all, of the non-economic effect of endowment. At the same time, as our variation in expectations (from 1% to 99%) captures almost the entire possible range, our expectations treatment is designed to capture almost all of the economic (KR-esque) effect of endowment. For this and other reasons discussed later in the paper, one should be cautious in interpreting this comparison.

[6]Indeed, assignment in the Weak Expectations treatment should have virtually no effect on choice if endowment affects outcomes *only* through establishing expectations (that is, if additional, non-economic effects of endowment do not exist). However, neither KR nor (to our knowledge) anyone else has suggested this extreme interpretation of KR's model; while offering one potential channel from endowment to choice, the model does not rule out the coexistence of other channels.

probability with which subjects will be able to trade the mug later for a pen; the probability can be either 10% (a strong expectations treatment) or 90% (a weak expectations treatment). EF find that 77% and 44% of mug owners, respectively, choose to keep the mug in the two treatments.[7] In other words, they find that once a good is endowed, their expectations treatments do affect choice (by 33 percentage points).

Why did expectations have the effect predicted by KR in EF's experiment but not in ours? Since the disparate findings cannot be reconciled within the KR model, our explanations focus on cross-experiment differences—e.g. differences in experimental procedures and other implementation details—that from the model's point of view are not expected to matter. In order to assess these explanations, as well as to verify that our findings replicate under modified implementation details, we conduct a second experiment. Its design has a dual purpose: first, it attempts to eliminate some of the most salient implementation differences between our first experiment and EF's; and second, it attempts to further explore our results, including the non-economic effect.

Among our second experiment's design modifications, we change the probabilities in the expectations treatments to 10% vs. 90% (from 1% vs. 99%). This change both makes our expectations treatment more similar to EF's and allows us to check the robustness of our findings. We also turn our original 2×2 design into a 2×2×2 design by adding an endowment treatment to augment the two original treatments. Our second experiment thus includes a "More Endowment" condition, under which a full version of our first experiment is conducted but the goods are no longer treated symmetrically, and assignment comes with strong endowment- and ownership-related language that closely follows the language used by EF. It also includes a "Less Endowment" condition, under which another full version of

[7] On the other hand, EF find the opposite result—38% and 71%, respectively, choose to keep the mug in their strong and weak expectations treatments—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.

our first experiment is conducted, with assignment language that attempts to minimize even implicit hints of ownership that may be driving the non-economic effect we find in our first experiment.

Among our second experiment's findings, in the More Endowment condition we essentially replicate the findings from our first experiment: while we find that assignment affects choice—subjects are more likely to choose an item when it is assigned to them by the coin-flip than when it is not (this time by 20 to 22 percentage points on average)—we again find no evidence that the effect is larger in the Strong than in the Weak Expectations treatment. This replication, under conditions that include the dramatic increase in endowment-related language, the change in probabilities, and other implementation changes (including slightly different subject population and items), rules out important potential explanations regarding the differences in the role of expectations across our and EF's results.

Taken as a whole, our results suggest that while mere assignment can, under some conditions, have an important effect on choice that is not easily explainable by *any* economics model to date, expectations per se may fail to generate the effect predicted by KR's model. This may in turn suggest that for a full explanation of Knetsch's original result, current economics models may be too narrow—as they leave out a potentially important part of the explanation—and, at the same time, may be too broad—as their notion of expectations may not be sufficiently refined. In particular, our results lend support to the idea that different experimental procedures may result in different conceptions of expectations, in turn giving rise to different expectations-driven effects. This insight not only speaks to this particular line of research, but given the recent explosion of work exploring expectations and beliefs has implications much broader. For example, theoretically, it highlights that we should carefully consider the source and nature of expectations. Empirically, it cautions us that there is a risk that the imposition of an exogenous laboratory control might affect the very aspect that we are studying in ways not predicted by theory.

The remainder of our study proceeds as follows. Section 2 describes the design of our

first experiment and discusses the theoretical framework that motivates it. Section 3 presents the results from our first experiment. Section 4 describes the motivation and design of our second experiment, and Section 5 discusses its results. Section 6 concludes.

2 Experiment 1: Assignment and Expectations

In this section we describe our first experiment, solve KR's model in the context of our experiment, and derive experimental predictions. We start with a brief outline of a simple version of the model.[8]

2.1 The KR Model

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 $x\leq0$. 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.

[8]KR's model could be viewed as consisting 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 behavior.

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).

2.2 Experimental Design

We now apply KR's model to our first experiment. The main contribution of our experiment is that it disentangles assignment from expectations: our 2×2 design separately varies a subject's assignment to an item and her expectations regarding how much assignment will matter for the choice sets she will face. We do the former by a coin flip and the latter 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.

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 Expectations 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 <u>will be able</u> to choose which item you take home. However, there is a 99% probability that you <u>will NOT be able</u> 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 Expectations treatment is identical, but "1%" is replaced with "99%," and "99%" is replaced with "1%." The reminder 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 Expectations 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 any questions. After all 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).[9] Having completed the survey, they are asked to make their choice of an item. Their choice is our outcome of interest.[10] 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

[9]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.

[10]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.

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), cannot arise in our experiment. This in turn guarantees that an effect of coin-flip assignment on choice in our experiment cannot be explained by the standard model.

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.

2.3 Solving the Subject's Consumer Problem

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.[11] 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.

2.4 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 Expectations) treatment, subjects

[11] 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.

expect to consume the default c_1 with very high probability. According to KR, choosing c_2 would 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.[12] Under these assumptions, according to KR, coin-flip assignment should affect choice. On the other hand, in the $q = 0.99$ (Weak Expectations) treatment, assignment is not expected according to KR to affect choice, and half the subjects are expected 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 coin-flip assignment on choice under any of the four experimental conditions 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.[13] (ii) Finding coin-flip assignment 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 coin-flip assignment effect under both expectations 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 non-economic effect, 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, and one could compare the magnitude of the non-economic effect with that of the economic effect. (iv) Finally, we are aware of no theory

[12] 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.

[13] 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.

(or combination of theories) 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).

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 that these subjects fully understood the instructions, and formed expectations as intended by the experimental design.[14] 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 leftmost column, titled "All," shows that overall, across the two expectations treatments, coin-flip assignment affects subjects' 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 different from zero with p-value = 0.06.

[Table 1 about here.]

The next two columns of Table 1 report results by expectations treatment. They show that the effect of coin-flip assignment on choice cannot be explained by expectations: the difference in proportions in the Strong Expectations treatment (8%) is in fact roughly half that in the Weak Expectations treatment (17%). Indeed, the rightmost column shows that

[14]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. We return to this point in the next section.

while in the Strong Expectations treatment 3% less coin-pen subjects chose mug than in the Weak Expectations 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 at conventional levels.

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 manipulation check—on the first attempt. Among these subjects coin-flip assignment 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 Expectations treatment (17%) than in the Weak Expectations 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 than in the Strong Expectations 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.]

To summarize, empirical results in Tables 1 and 2 suggest that while coin-flip assignment affects subjects' choices, it does not do so more in the Strong Expectations treatment. While the former cannot be explained by the standard neoclassical model, combined with the latter it cannot be explained by KR either.[15] Our interpretation of the results from our first experiment is hence that (a) we find effects of coin-flip assignment on choice that are not readily explained by either economics model, and could be referred to as non-economic or as

[15]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.

psychological;[16] and (b) we find no evidence of additional, KR-esque effect of expectations on choice on top of this non-economic effect.[17]

4 Experiment 2: Assignment, Expectations, and Endowment

As aforementioned, concurrently to our research Ericson and Fuster (2010) conducted an experiment in the spirit of our first experiment. How do our results compare with theirs?

First, regarding the non-economic effect we find, EF's experiment is silent: while our 2×2 experiment varies both assignment and expectations, EF's experiment assigns all subjects to the same item (by endowing all with a mug), and varies only expectations. Indeed, to the best of our knowledge, our non-economic effect constitutes a new result: it is the first demonstration that assignment to an item can affect choice even when all previously suggested confounds from the perspective of the neoclassical model have been eliminated and, importantly, even when subjects demonstrably know that assignment has virtually no effect on expected ownership. One of the purposes of our second experiment is hence to replicate this new result.

[16] In a previous version of this paper (Heffetz and List, 2011) we report the results of a follow-up experiment that was designed as an attempt to further disentangle our experimental procedures from expectations. In that experiment we find no strong evidence that any of the treatments matters much, but due to a complicated design and to a social component that is perhaps introduced, these findings may be hard to interpret. See Heffetz and List (2011) for details (including experimental instruments and detailed result tables).

[17] One technical concern regarding Tables 1 and 2 is related to the fact that, as seen in the Weak Expectations 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 assign them to which item. Third, and most importantly, unbalanced coin-flips are only found in the Weak Expectations 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 Expectations treatment, where the coin-flip strongly affects subjects' outcomes (by simply eliminating choice and determining their gift with 99% probability), the coin-flips are perfectly balanced.

Second, regarding our failure to find a KR-esque effect of expectations, our results starkly contrast with those of EF, who find that assignment has a larger effect on choice in their strong compared with their weak expectations treatment. In the rest of this section we discuss potential explanations for the different results, and explain how our second experiment is designed to further explore some of these explanations. For an example of the master document from which our second experiment's instructions were created (as well as a photo of the experimental setup) see Appendix B.[18]

4.1 Experimental Design

KR's theory alone cannot explain the different findings across our experiment and EF's. Indeed, from the theory's perspective, once coin-flip assignment has been determined in our experiment, the two experiments are equivalent with one exception: while our expectations variation includes 1% and 99% treatments, EF's includes 10% and 90% treatments—but according to the theory, this difference should lead to a *larger* effect of expectations in our experiment. In other words, from the theory's perspective, our and EF's experiments are two equivalently-clean attempts at demonstrating the theory's potential to explain at least some of Knetsch's (1989) effect. That EF find that expectations could explain some of the effect while we find no such evidence is, from the theory's perspective, puzzling.

At the same time, our first experiment and EF's experiment naturally differ in many implementation details. And while KR's theory does not predict them to matter, one might worry that—due to explanations that go beyond KR—they do matter. Below we list what we hypothesized could be six such explanations.

(1) A potential concern regarding the design of our first experiment is that a 1%-probability event may be perceived by subjects as so unlikely to occur that they do not choose carefully. While this possibility cannot easily explain our findings, it motivated us to change the probabilities in our second experiment from 1% vs. 99% to 10% vs. 90%, as in

[18] As explained below, yellow and blue highlights in the master document each represent a different endowment treatment.

EF's experiment.

(2) While in our first experiment assignment to an item does not use explicit endowment language, EF endow their subjects with a mug using expressions like "the mug in front of you is yours, you own it," "you may have the option to exchange your mug for the pen," "[y]ou own this item for real," "keep the item you currently own," etc. Since we hypothesized that the effect on choice of an expectations manipulation might depend on whether or not expectations are accompanied by a strong sense of endowment and ownership, our second experiment adds an endowment manipulation to our first experiment, turning it from a 2×2- to a 2×2×2-design experiment.

The master document in Appendix B contains the full instructions of a "More Endowment" treatment (by reading only text with blue highlights or no highlights) and the corresponding "Less Endowment" treatment (yellow highlights and no highlights). Each of the two new endowment treatments consists of a full version of our first experiment, with or without explicit endowment language. Thus, for example, where the instructions in the Less Endowment treatment read "there is a 10% probability that you will be able to choose which item you take home," in the More Endowment treatment they read "The item you own is yours to keep. You own it for real, not just for the purpose of the study. There is a 10% probability that you will be able to exchange it for the other item if you want to." More generally, the language in our More Endowment treatment closely follows the endowment-laden language in EF. This includes, for example, asking subjects to write "keep" or "trade" to indicate their choice (as opposed to writing the more symmetrical "pen" or "mug" in the Less Endowment treatment).

Moreover, while our first experiment already carefully avoids explicit endowment language, the Less Endowment treatment in our second experiment is rewritten to also reduce language that might *implicitly* lead subjects to think about endowment or ownership. Thus, for example, while subjects in our first experiment encounter the word "gift" nineteen times by the time they indicate their choice, in our second experiment's Less Endowment treatment

they encounter it only six times.[19]

(3) As EF mention in their paper, one psychological mechanism that may explain their findings runs 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 an 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" (see details below) that they spent more time thinking about the mug than about the pen. This interpretation of the data could indeed explain the difference between our results and theirs if the strength of the link from expectations to time spent thinking—the extent to which expecting an outcome to occur with higher probability leads to thinking more about the outcome—varies across the experiments. Indeed, if expectations affect outcomes due to the time spent thinking about the outcomes, then the implementation details of how expectations are manipulated in each specific experiment (through repeated explanations, reminders to subjects, visual cues, etc.) might be what drives each experiment's findings. But then, experiments that are viewed as tests of KR could in reality be testing special cases of "time spent thinking" theories.

To explore this possibility, we elicit in our second experiment data comparable to EF's on subjects' time spent thinking about the items. Specifically, after subjects make their choice, they are instructed as follows:

[19]The fact that the word "gift" is not entirely eliminated from the instructions merely reflects our attempt to keep the instructions' language intuitive and easy to understand. More generally, our effort at reducing implicit endowment language in the instructions is far from theory-based and should be treated as exploratory. It is intentionally restrained by deliberately avoiding replacement language in cases where we feared the resulting "cleaned up" instructions would feel too contrived. We carefully refer to our endowment treatments as More vs. Less Endowment (rather than, say, Full Endowment vs. No Endowment) to reflect this fact.

Before opening your envelope, please carefully read and think about each of the following statements. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. **Notice that the scale now goes from 1 to 7.**

Disagree strongly	Disagree	Disagree a little	Neither agree nor disagree	Agree a little	Agree	Agree strongly
1	2	3	4	5	6	7

___ a. I like the pen better than the mug.

___ b. During the session, I have spent some time thinking about how I would use the pen.

___ c. During the session, I have spent some time thinking about how I would use the mug.

___ d. During the session, I have spent more time thinking about the pen than about the mug.

___ e. During the session, I expected the pen to be the item I take home.

___ f. During the session, I expected the mug to be the item I take home.

___ g. During the session, I expected the pen more than the mug to be the item I take home.

___ h. During the session, I felt that I owned the pen. I felt that it was already mine.

___ i. During the session, I felt that I owned the mug. I felt that it was already mine.

___ j. During the session, I felt that I owned the pen more than I felt that I owned the mug.

Statements *a*–*d* above are almost identical to EF's statements 1–4, with statements *b*–*d* yielding comparable data on subjects' time spent thinking about the items.[20] We added to the latter three statements two additional sets of three statements that mimic their structure and elicit subjects' reports regarding which item they expected to take home (statements *e*–*g*) and regarding feeling of ownership towards the items (statements *h*–*j*). These additional six statements serve two purposes. First, they are aimed to provide additional evidence on the effects of our treatments on expectations and on feeling of endowment/ownership (see point (4) below). Second, importantly, the two sets of statements are aimed to be comparable to the set of time statements *b*–*d*, thus providing evidence on our treatments' effects on time spent thinking, on expectations, and on ownership feeling *relative* to each other.

(4) One may question whether understanding probabilities (e.g. as demonstrated by answering our quiz questions) can indeed be identified with the psychologist's notion of forming

[20] EF's statements 1–4 are: "I like the mug better than the pen." "Since the beginning of the session, I have spent some time thinking about how I would use the pen." " Since the beginning of the session, I have spent some time thinking about how I would use the mug." and "Since the beginning of the session, I have spent more time thinking about the mug than about the pen." Their response scale ranges from 1 to 5.

expectations. We again note that since our experiments are designed in the framework of KR's model, our implementation of "expectations" closely follows their definition, which equates them with beliefs regarding probabilities. However, if one draws a distinction between "understanding probabilities" and "expecting" one might worry that, for whatever reason, while under EF's experimental procedures probabilities and expectations coincide, under our procedures they do not. Statements *e*–*g* above help us explore the possibility that while our subjects understand the instructions, they do not report an effect on their expectations.

(5) Relatedly, as KR repeatedly note, their theory is somewhat vague on the timing of expectations formation: "Psychological and economic judgment is needed, for instance, in choosing the appropriate notion of "recent expectations."" While the timing of expectations formation seems roughly comparable across our experiment and EF's, it is perhaps even more so in our second experiment, where the time-filler survey is shorter (it is a one-page "Big Five" personality traits questionnaire (John and Srivastava, 1999) similar to what EF use).

(6) Finally, and also related to the last two points, recall that in KR's model, once PPE expectations are formed, individuals' choices never deviate from equilibrium choices. More generally, consumers in rational choice models are assumed to never ignore information—information regarding probability distributions being only one example—when making their choices. However, in reality (and specifically, in the reality of experiments) it is likely that expectations and other types of information affect choices only to the extent that individuals pay attention to them at the moment of making the choice. This is simply another way of stating the perhaps trivial observation that in the case of informational manipulations, effect size depends not only on the size of the manipulation (e.g., 10% vs. 90% probability) but also on its salience (e.g., how many times the information is repeated to subjects, how it is emphasized visually on the page (or on the screen), how it is framed, etc.). One could always worry that while our subjects form expectations as intended by our treatments, they

later forget them or simply do not pay enough attention to them.

In principle, this concern is hard to address without a theory of attention or of saliency of informational manipulations. It is quite possible that EF's manipulation is more salient, e.g. due to their use of computer screens (which are perhaps more attention-grabbing than our paper instructions); their use of pictures for illustrating probabilities; the many repetitions in their instructions; etc. Indeed, if these differences between the experiments explain the different results, then it is not clear how useful KR's model is without specifying the implementation details that are required for expectations to affect choice.

At the same time, our first experiment is careful, for example, to not emphasize assignment more than expectations. So while we cannot rule out that EF's expectations manipulation is "stronger" than ours in some sense that is not specified by the theory, our expectations manipulation seems roughly as strong as our assignment manipulation—which in turn is strong enough to affect choice.

As a further check on the relative saliency of our expectations vs. assignment manipulations, in our second experiment's instructions we avoid mentioning the coin-flip from the moment a respondent finished answering the quiz questions until after she chooses an item. Furthermore, we add a reminder, just before a subject indicates her choice, that her choice is real and that she should choose according to her preferences.[21] Finally, remember that in our second experiment we elicit subjects' own statements e–g regarding their expectations. These statements, which appear immediately after subjects indicate their choice, provide further evidence regarding the strength and persistence of our expectations manipulation.

[21]Specifically, in our first experiment the paragraph immediately before a subject is asked to make her choice reads:

> 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.

In our second experiment, we drop the part of the text that starts with the word "regardless" and ends at the end of the paragraph above, replacing it with a full stop followed by an underlined sentence that reads:

> Remember that at the end of the session you will actually take home with you one of the items; fill in the box below according to the item you prefer.

4.2 Predictions

In this 2 {Coin-Mug vs. Coin-Pen} × 2 {Strong Expectations vs. Weak Expectations} × 2 {More Endowment vs. Less Endowment} design experiment, the standard neoclassical model still does not predict an effect on choice of any of the treatments, while 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-flip assignment should affect choice more in Strong than in Weak Expectations cells, regardless of endowment condition. Finding such a KR-esque effect of expectations in our second experiment would suggest that its absence in our first experiment might be due to implementation details such as the 1%-vs.-99% probabilities, the timing of expectations formation, or a low relative saliency of expectations by the time subjects make a choice (explanations (1), (5), and (6) in the previous subsection); while finding the effect only in the More Endowment condition would suggest a necessary interaction between expectations and endowment (explanation (2) above).

Additionally, the ten statements a–j shed light on whether our expectations manipulation affects the time subjects spend thinking about the items, and on whether it affects subjects' own perceptions of their expectations (explanations (3) and (4)).

Finally, recall that the effect found in our first experiment, of assignment on choice regardless of expectations, is predicted by none of the economic theories and hence does not lend itself readily to theory-based hypotheses. That said, the variation introduced in our second experiment between the More and Less Endowment treatments explores this non-economic effect both under more explicit and under less implicit references to ownership and endowment relative to our first experiment.

5 Experiment 2: Results

Our second experiment was conducted during May 2011 at a large university in the Northeast. 233 subjects participated. We again start with their replies to the quiz questions and then

move to analyze their choices. We close with analyzing their post-choice statements.

5.1 Expectations

The two quiz questions in our second experiment are identical to those in our first experiment, with two modifications that reflect the new experimental design: (a) the probabilities change to 10% and 90%; and (b) the word "gift" is eliminated (the language "My gift will be the one I choose" is replaced with "I will take home the item I choose;" see Appendix B).

Of our 233 subjects, 208 (89%) answered question 1 correctly on first attempt, and 16 of the remaining 25 answered it correctly on second attempt. In question 2, 212 subjects (91%) answered correctly on first attempt, and 13 of the remaining 21 answered it correctly on second attempt. Overall, 200 subjects (86%) answered both questions correctly on first attempt. We again present our results for the entire population and for these 200 subjects.

5.2 Choice

Tables 3 and 4 present our experimental results. Each of the tables consists of two panels, corresponding to the two endowment treatments (titled "More Endowment" and "Less Endowment"). Each panel has a structure identical to that of Tables 1 and 2.

[Table 3 about here.]

[Table 4 about here.]

Overall, results in the More Endowment panel in Tables 3 and 4 suggest that our main findings from Experiment 1 are robust to re-setting expectation probabilities at 10%-90%, adding strong endowment language to the instructions, and otherwise modifying the design as discussed above. Qualitatively, the results in this panel in the two tables replicate those in Tables 1 and 2, and lead to the same two conclusions. First, the leftmost column shows that overall, coin-flip assignment affects choice: the difference between the proportion of

mug choosers among coin-mug vs. coin-pen subjects is 22% ($p = 0.01$) in Table 3 and 20% ($p = 0.02$) in Table 4. Second, the next two columns show no evidence that the difference is larger in the Strong than in the Weak Expectations treatment. Indeed, as in Experiment 1 and contrary to KR's prediction, its point estimate is *smaller*: in Table 3 it is 11% in the Strong Expectations treatment, compared with 31% in the Weak Expectations treatment; in Table 4, it is 18% compared to 23%.

This replication of a coin-flip assignment effect without a KR-esque expectations effect reinforces our interpretation of the findings from our first experiment. For example, it provides additional evidence that the absence of the latter effect cannot be explained by how the specific items in our experiments enter preferences: in terms of the utility function described in Section 2, the coin-flip effect suggests that for many subjects, m_1 (c_1) and m_2 (c_2) cannot be too far apart.

Finally, the bottom panel in Tables 3 and 4 reveals that the above effect of coin-flip assignment on choice does not replicate in the Less Endowment treatment. The leftmost column in either table shows a *negative* effect (not statistically significant, at -9% and -8% in Tables 3 and 4), and the next two columns show that while there is virtually no effect of assignment on choice in the Strong Expectations treatment (1% and 2% in Tables 3 and 4), there is a negative and rather large effect in the Weak Expectations treatment (-18% and -19%, which would have been somewhat statistically significant had we started with a reversed hypothesis). While we are careful not to over-interpret these findings, we note that they are consistent with the (perhaps trivial) notion that the psychological effects of assignment are sensitive to framing, and that "cleaning up" the language in our instructions in certain ways may eliminate or even reverse them.

5.3 Statements

Figures 1 and 2 summarize data on responses to the ten post-choice statements. Since each of the two figures presents eighty means (and eighty 95% confidence intervals), we discuss

here the general picture rather than each individual result and test.

[Figure 1 about here.]

[Figure 2 about here.]

Both figures show that while the top two rows (statements a–d) have little cross-treatment variation in mean responses—differences across treatments are small and are not statistically significant—the bottom two rows (statements e–j) show differences across treatments that are large and are often statistically significant. This can be seen most vividly by scanning each of the ten mini-graphs individually, and by comparing the effects of assignment—that is, by comparing the mean responses of coin-pen subjects (squares) with those of coin-mug subjects (diamonds)—within each of the four expectations-endowment conditions.

Recall that while statements a–d are designed to reproduce closely EF's four statements regarding liking or spending more time thinking about one of the items versus the other, the new statements e–j are designed to provide further information about subjects' self-reported expectations or feelings of ownership during the experiment. Hence, while the large assignment effects on responses to the latter provide additional evidence that our assignment, expectations, and endowment treatments indeed "worked" as intended, the absence of such effects on responses to the former suggests that they did not additionally affect how much subjects liked the items or how much time they spent thinking about them.

In the reminder of this section we discuss in detail the responses to statements a, d, g, and j. These statements correspond to the rightmost mini-graph on each row of Figures 1 and 2, and they explicitly ask responses to *compare* the pen and the mug. The reader can verify that results in the rest of the mini-graphs are consistent with the results we discuss.

We start with statement a in the top row: "I like the pen better than the mug." While EF find that the responses to a similar statement differ across their expectations treatments (by 0.7 on a 1–5 scale, with two-sided Wilcoxon-Mann-Whitney p-value of 0.06), we find

consistently smaller (and even reversed) differences. For example, among our More Endowment subjects—whose experimental condition may be the most similar to that of EF's subjects—we find small and statistically insignificant effects of assignment in both expectations treatments, and we find small and insignificant differences between these effects across Weak and Strong Expectations (the difference in difference is 0.5 on a 1–7 scale in the "wrong" direction in Figure 1, and of 0.1 in the "right" direction in Figure 2).

Now consider statement d in the second row: "During the session, I have spent more time thinking about the pen than about the mug." Looking again at the effects of assignment among More Endowment subjects, we find that they are again small and insignificant and, importantly, are similar across expectations treatments (comparing Weak with Strong Expectations treatments, the assignment effect goes in the "wrong" direction by 0.2 and 0.1 on a 1–7 scale in Figures 1 and 2). In comparison, EF find that responses to a closely similar statement differ across their expectations treatments (in the "right" direction, by 0.8 on a 1–5 scale, p=0.06).

While our treatments do not affect statements regarding liking or spending time thinking about one item versus the other, they have large effects on statements regarding expectations. This is seen in statement g in the third row: "During the session, I expected the pen more than the mug to be the item I take home." The effect of assignment on the responses to this statement doubles from Weak to Strong Expectations among More Endowment subjects (from 1.6 on a 1–7 scale to 3.1 in Figure 1 and from 1.3 to 3.1 in Figure 2) and more than triples among Less Endowment subjects (from 1 to 3.7 and from 1 to 3.5 in the two figures). These findings provide additional evidence suggesting that our expectations treatments indeed affect expectations as intended, in both endowment conditions. Interestingly, they also suggest that relatively low probabilities (of 10%) might sometimes be enough for a statistically significant effect of coin-flip assignment on respondents' self-reported expectations.

Finally, statement j reads: "During the session, I felt that I owned the pen more than I felt that I owned the mug." Responses to this statement suggest that our endowment treatments

are indeed successful in generating feelings of ownership. Among More Endowment subjects, the effects of assignment on responses are large and statistically significant in both figures and, depending on expectations treatment, are almost two to four times larger than the corresponding effects among Less Endowment subjects. That these effects are consistently larger under Strong (vs. Weak) Expectations suggests—perhaps not surprisingly—that our expectations treatments, in themselves, affect feelings of ownership. This in turn highlights the issue that one may not be able to keep subjects' feelings of ownership (or of endowment) perfectly constant while manipulating expectations. This is seen most clearly among Less Endowment subjects: while the effects of assignment here are not statistically different from zero under Weak Expectations (at 0.5 in both figures), they remain highly significant under Strong Expectations (at 1.5 and 1.7).[22]

5.4 Interpretation

In terms of choice, we qualitatively replicate, under More Endowment, our first experiment's findings with different probabilities, explicit endowment language, a shorter time-filler survey, and no explicit reference to coin-flip assignment between quiz and choice. While this replication does not separately quantify the impact of each of these design changes but only the sum of their impacts, it suggests that points (1), (2), and (5) in Section 4.1 (regarding probabilities, endowment, and timing) are not likely to jointly explain either our original findings or why they differ from EF's. As to point (6) (regarding the salience of informational manipulations), while it may well explain why our results are different from EF's, our replication provides rather strong evidence regarding the relative magnitude of assignment effects vs. expectations effects—evidence that EF do not have. At the same time, our choice findings under Less Endowment demonstrate the sensitivity of assignment effects to framing.

In terms of subjects' post-choice statements, we find that while our expectations manipu-

[22]The possibility that expectations may in themselves affect feelings of ownership is especially interesting in the context of the attempt to interpret the original endowment effect as an expectations effect—an attempt that emphasizes the causal link in the reverse direction, from feelings of ownership to expectations.

lation affects subjects' reports regarding their expectations, it does not make subjects spend more time thinking about (or liking) one of the items. This suggests that while subjects perceive our informational manipulation of probabilities as affecting their expectations—rendering point (4) less of a concern—manipulating expectations might not in itself be sufficient for affecting behavior, as discussed in point (3).

6 Conclusion

The two experiments reported in this paper replace Knetsch's (1989) endowment treatment with an assignment treatment and an expectations treatment, accompanied by more or by less endowment language. We find, first, that assignment can affect choice in a way that is not easily explained by existing economics models; and second, we find no evidence of a KR-esque effect of expectations on choice.

To the best of our knowledge, both of these findings are new. The former suggests that there is something about assignment that has perhaps been underestimated by economists and that—depending on framing—can have an important effect on behavior even when all past economic explanations are controlled for, including information confounds, demand effects and, importantly, expectations.

As to our latter finding, its contrast with EF's finding cannot be reconciled within the KR model, even when the model is extended to include certain basic requirements regarding implementation. This suggests that the notion of expectations employed by economists might be too crude to account for observed differences in expectations' effects on behavior across experiments. The finding in our second experiment—that our treatments unambiguously affect respondents' statements regarding expectations and endowment but have no comparable effect on statements regarding liking or spending time thinking about the objects—provides a direction in which different lab manipulations of expectations can result in different effects on subjects' perceptions. This finding suggests an important direction in which our

conceptualization of expectations could be refined.

While we suspect that expectations regarding outcomes matter for consumer choices in certain contexts, we fail to find supporting evidence in the context of Knetsch's (1989) endowment effect.[23] We trust that future work—both theoretical and experimental—will think carefully about the source and nature of expectations. While in economists' models expectations are often equivalent to beliefs about probability distributions, our findings suggest that the context in which expectations are established matters a great deal. Beyond these experiments and beyond the points we emphasize in this paper—e.g. regarding the salience of informational manipulations—one might further 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. These all serve as important research avenues going forward.

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[23]To the best of our knowledge, our and EF's studies are the first direct tests of KR's model in the context of Knetsch's (1989) original experiment. Recent experimental work that tests KR's model in other contexts include Abeler et al. (2011), who test the model's predictions for effort provision; Smith (2008), who tests for a WTP-WTA gap; and Ericson and Fuster's (2010) WTA experiment.

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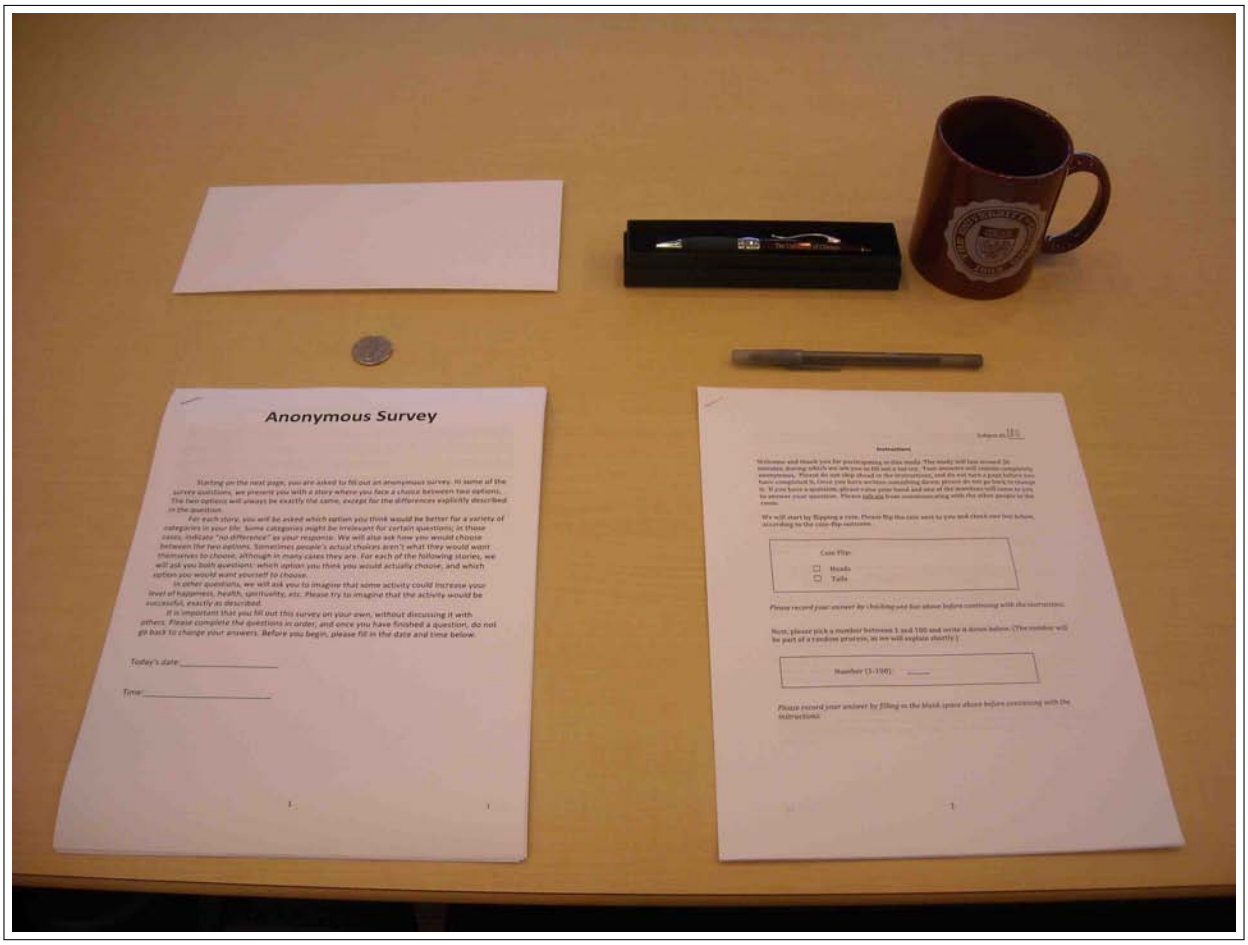
Appendix A: Experiment 1 Instruments Example



[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.

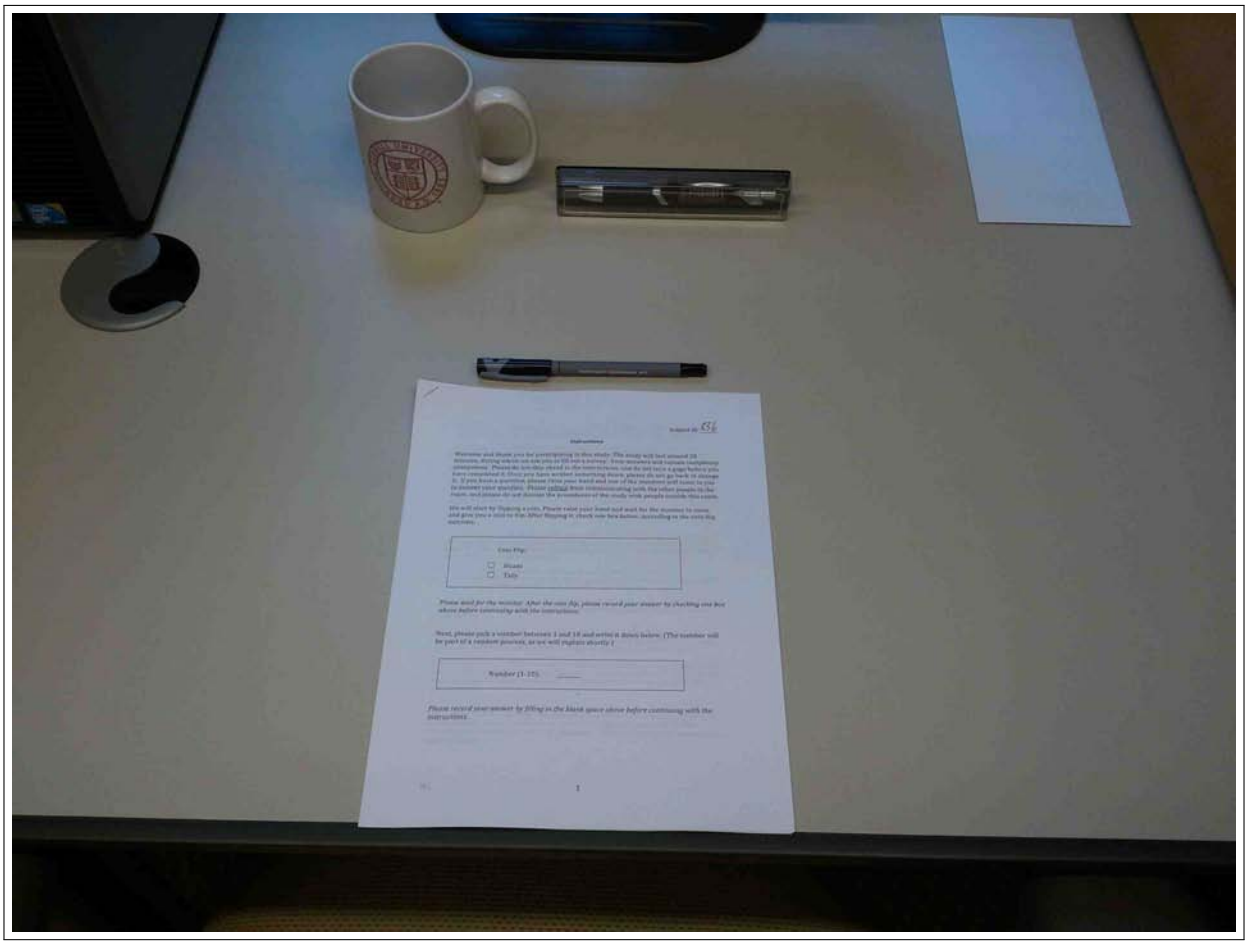
If the number you wrote down is NOT the same as the number in the envelope, your gift will be the one determined by the coin flip in the beginning.

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.]

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, and please do not discuss the procedures of the study with people outside this room.

We will start by flipping a coin. Please raise your hand and wait for the monitor to come and give you a coin to flip. After flipping it, 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 10 and write it down below. (The number will be part of a random process, as we will explain shortly.)

Number (1-10): _____

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 Your coin-flip has determined which one of them belongs to you as a gift to take home. Whether or not you can choose your gift to exchange your item for the other item is determined at random, as explained below in detail.

In brief, there is a 10% probability that you will be able to choose which item you take home. However, there is a 90% probability that you will NOT be able to choose, and that your take-home gift will automatically be the pen if you flipped "heads" and automatically be the mug if you flipped "tails." In brief, you own the pen if you flipped "heads" and the mug if you flipped "tails." The item you own is yours to keep. You own it for real, not just for the purpose of the study. There is a 10% probability that you will be able to exchange it for the other item if you want to. However, there is a 90% probability that you will NOT be able to exchange it.

Remember that everything written in these instructions is real: you will actually leave the room at the end of the session with one of the two items. 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 item you take home whether or not you can exchange your item. When you are finished with the survey, before you go home with one of the items, the outcome of a random process will determine if you can choose your take-home item exchange the item you own for the other item. This process will be as follows:

1) We will ask you to choose which of the two items you want. whether you want to keep the item you own, or to exchange it for the other item.
2) We will ask you to open the sealed envelope next to you. The envelope contains a randomly-selected number between 1 and 10 inside.

If the number you wrote down in the previous page is the same as the number in the envelope, you will take home the item you have just chosen, regardless of your previous coin-flip. determined by your choice in (1). That is, if you have just chosen to keep the item you own, you will take it home; and if you have just chosen to exchange it, you will take home the other item.

If the number you wrote down in the previous page is NOT the same as the number in the envelope, you will take home the item determined by the coin flip: it will automatically be the pen if you flipped "heads" and automatically be the mug if you flipped "tails." you own. Remember that this was determined by the coin-flip: you own the pen if you flipped "heads" and the mug if you flipped "tails."

Notice that you have a 10% chance (or 1/10) to be able to choose exchange your take-

home item at the end of the survey. In other words, there is a pretty high probability that you will take home the item determined by the coin-flip, regardless of which item you choose. you own as determined by the coin-flip, regardless of whether you choose to keep or exchange it. 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 item you receive take home 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 10% 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.)

☐ I will take home the item I choose, regardless of the coin-flip.

☐ I will take home the _____, as determined by the coin-flip, regardless of my choice.

2. With 90% 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.)

☐ I will take home the item I choose, regardless of the coin-flip.

☐ I will take home the _____, as determined by the coin-flip, regardless of my choice.

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 take-home gift. whether you want to keep the item you own, or exchange it for the other item.

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?

You will shortly find out the outcome of the random process that determines whether or not you choose your take-home gift. can exchange the item you own.

Please indicate which gift, the pen or the mug, you would like to receive. whether you would like to keep the item you own or trade it for the other item, by writing "keep" or "trade" in the box below. Remember that at the end of the session you will actually take home with you one of the items; fill in the box below according to the item you prefer.

My choice: _____

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

Before opening your envelope, please carefully read and think about each of the following statements. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. **Notice that the scale now goes from 1 to 7.**

Disagree strongly	Disagree	Disagree a little	Neither agree nor disagree	Agree a little	Agree	Agree strongly
1	2	3	4	5	6	7

___ a. I like the pen better than the mug.

___ b. During the session, I have spent some time thinking about how I would use the pen.

___ c. During the session, I have spent some time thinking about how I would use the mug.

___ d. During the session, I have spent more time thinking about the pen than about the mug.

___ e. During the session, I expected the pen to be the item I take home.

___ f. During the session, I expected the mug to be the item I take home.

___ g. During the session, I expected the pen more than the mug to be the item I take home.

___ h. During the session, I felt that I owned the pen. I felt that it was already mine.

___ i. During the session, I felt that I owned the mug. I felt that it was already mine.

___ j. During the session, I felt that I owned the pen more than I felt that I owned the mug.

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

If the number you wrote down is the same as the number in the envelope, you will take home the item you chose. own if you chose "keep" and the other item if you chose "trade." If the number you wrote down is NOT the same as the number in the envelope, you will take home the item you own (as determined by the coin flip in the beginning).

The monitors will now come by and distribute your take-home items. You are free to leave once you have received your item.

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 item to choose?

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

	All	Weak Expectations ($q = 99\%$)	Strong Expectations ($q = 1\%$)	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 Expectations ($q = 99\%$)	Strong Expectations ($q = 1\%$)	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 233 Subjects)

	All	Weak Expectations ($q = 90\%$)	Strong Expectations ($q = 10\%$)	Difference Weak − Strong
		More Endowment		
(# coin-mug, # coin-pen)	(57, 60)	(32, 26)	(25, 34)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(42, 31)	(26, 13)	(16, 18)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(74%, 52%) diff = 22%	(81%, 50%) diff = 31%	(64%, 53%) diff = 11%	(17%, −3%)
Result	$p = 0.01$	$p = 0.01$	$p = 0.20$	$p = 0.93$, $p = 0.59$
		Less Endowment		
(# coin-mug, # coin-pen)	(63, 53)	(32, 26)	(31, 27)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(41, 39)	(20, 21)	(21, 18)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(65%, 74%) diff = −9%	(63%, 81%) diff = −18%	(68%, 67%) diff = 1%	(−5%, 14%)
Result	$p = 0.84$	$p = 0.94$	$p = 0.47$	$p = 0.33$, $p = 0.12$

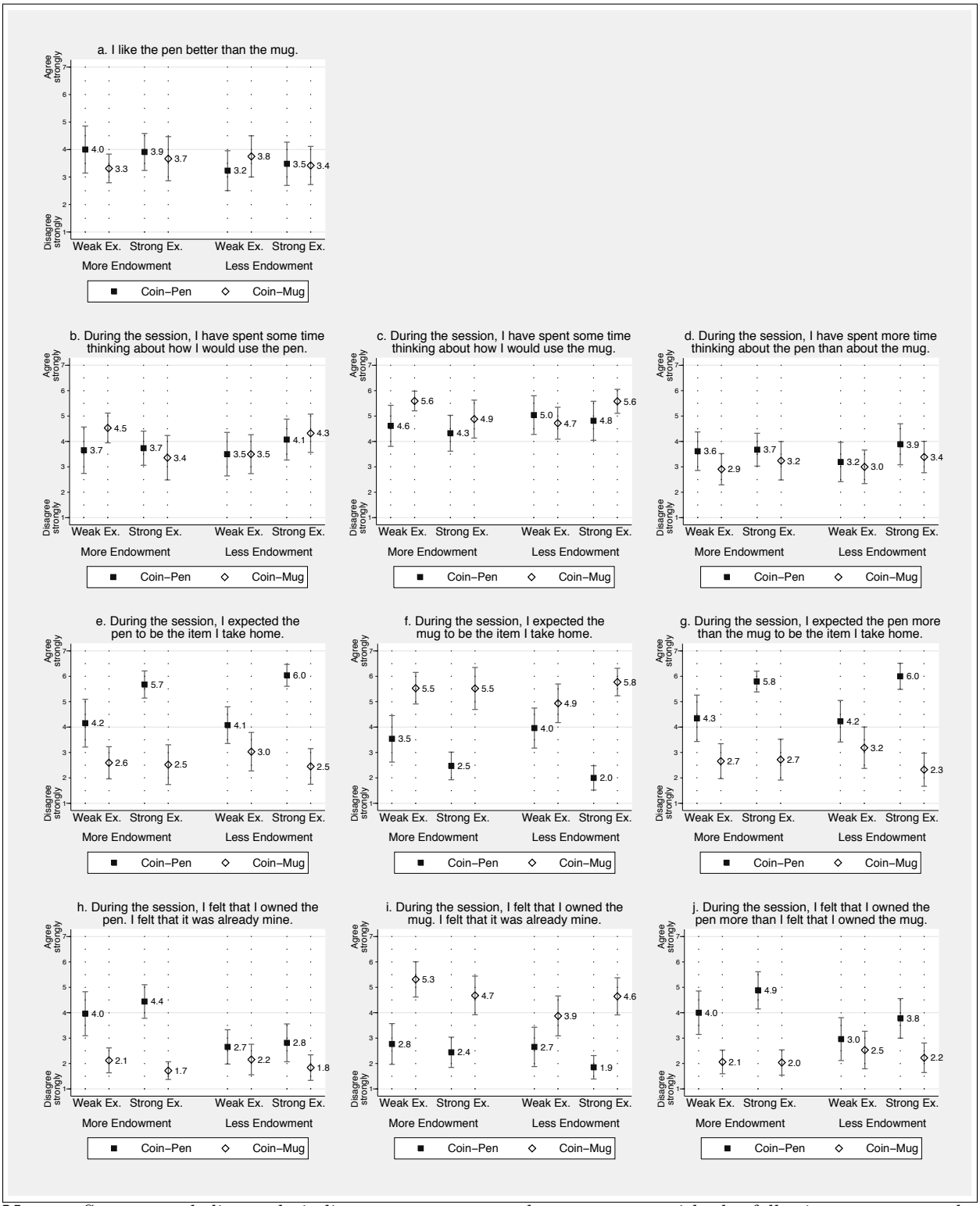
Notes: All p-values are from two-sample one-sided tests of equality of proportions.

Table 4: Choice by Coin-Flip in Experiment 2 (Only 200 Subjects Correct on First Attempt)

	All Correct	Weak Expectations ($q = 90\%$)	Strong Expectations ($q = 10\%$)	Difference Weak − Strong
	More Endowment			
(# coin-mug, # coin-pen)	(44, 54)	(21, 25)	(23, 29)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(31, 27)	(15, 12)	(16, 15)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(70%, 50%) diff = 20%	(71%, 48%) diff = 23%	(70%, 52%) diff = 18%	(2%, −4%)
Result	$p = 0.02$	$p = 0.05$	$p = 0.10$	$p = 0.55$, $p = 0.61$
	Less Endowment			
(# coin-mug, # coin-pen)	(55, 47)	(27, 23)	(28, 24)	
(# coin-mug who chose mug, # coin-pen who chose mug)	(34, 33)	(16, 18)	(18, 15)	
(% coin-mug who chose mug, % coin-pen who chose mug)	(62%, 70%) diff = −8%	(59%, 78%) diff = −19%	(64%, 63%) diff = 2%	(−5%, 16%)
Result	$p = 0.81$	$p = 0.92$	$p = 0.45$	$p = 0.35$, $p = 0.12$

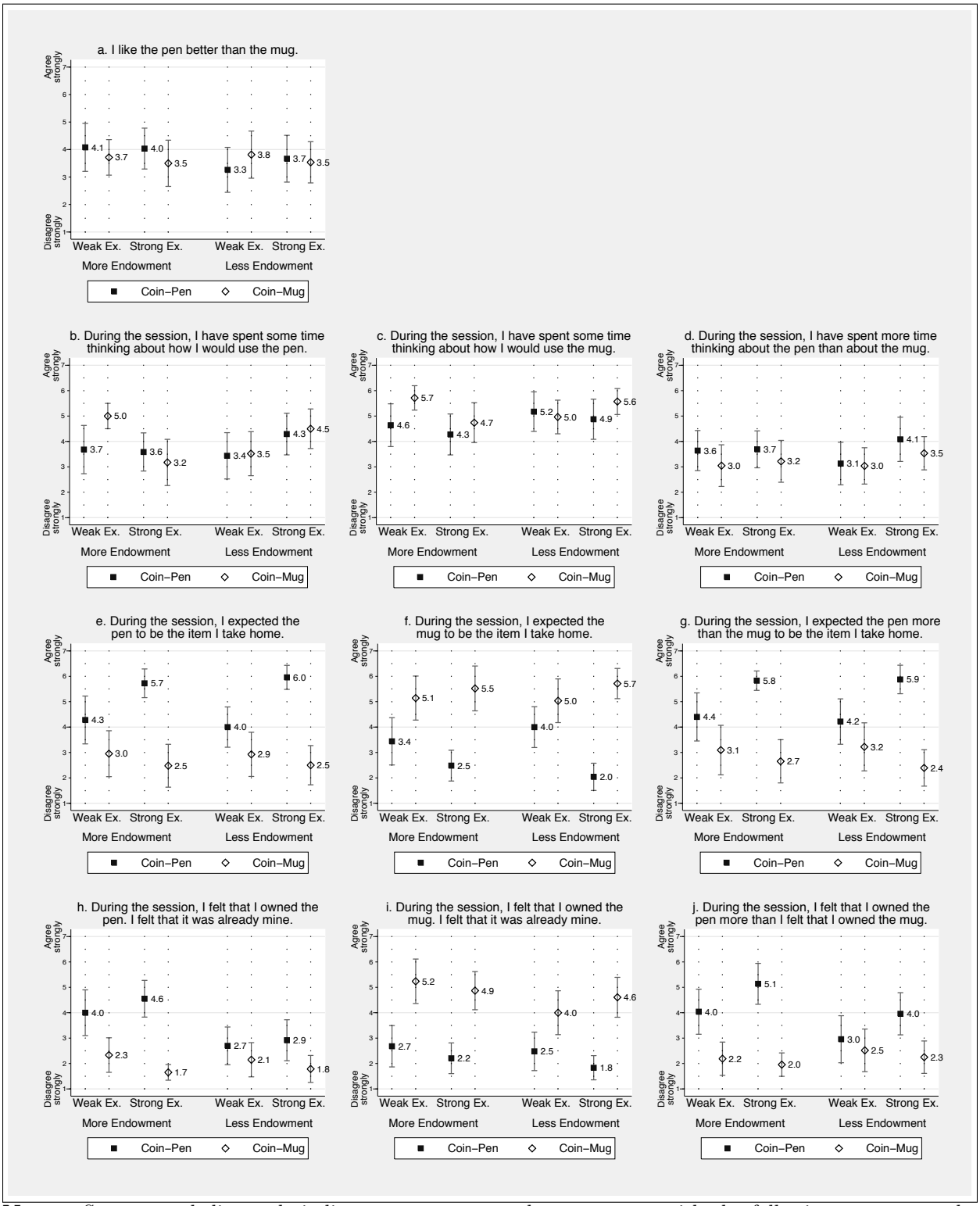
Notes: All p-values are from two-sample one-sided tests of equality of proportions.

Figure 1: Ten Statements in Experiment 2 (All 233 Subjects)



Notes: Squares and diamonds indicate mean response by treatment, with the following response scale: 1=Disagree strongly, 2=Disagree, 3=Disagree a little, 4=Neither agree nor disagree, 5=Agree a little, 6=Agree, 7=Agree strongly. Capped ranges indicate 95% confidence intervals.

Figure 2: Ten Statements in Experiment 2 (Only 200 Subjects Correct on First Attempt)



Notes: Squares and diamonds indicate mean response by treatment, with the following response scale: 1=Disagree strongly, 2=Disagree, 3=Disagree a little, 4=Neither agree nor disagree, 5=Agree a little, 6=Agree, 7=Agree strongly. Capped ranges indicate 95% confidence intervals.