The Effect of Initial Endowments in Experimental Auctions

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Abstract: We report the results of an experiment designed to test whether initial endowments affect value estimates elicited from experimental auctions. Comparing bids for one unit of a good, two units of a good, and a second unit of a good when endowed with the first unit, we find that willingness to pay for the second unit of a good is, on average, as much as 75% higher when endowed with the first unit. We go on to advance two theories that could potentially reconcile our results with neoclassical consumer theory. (JEL: C91, D12, D44)

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Running Head: Initial Endowments in Experimental Auctions

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When consumers purchase products at a store or in a conventional auction outside of an experimental setting, the market usually consists of a nonbarter exchange, where consumers pay money for a good. However, researchers using experimental auctions to estimate the value of new products or product traits routinely endow participants with one good and then offer them the chance to bid to upgrade to a (presumably superior) good possessing the trait of interest.[1] Participants' bids are interpreted as the value they place on this trait. Yet this simple analysis is not consistent with the large body of behavioral literature suggesting that preferences are reference dependent.[2] This endow-and-upgrade approach may also yield value estimates confounded by a "top-dog effect" (i.e., participants derive additional utility from being declared the winner of an auction) or by a sense of "reciprocal obligation" (i.e., participants wish to repay the experimenter for endowing them with a good).

In this article, we present the design and results of an economic experiment intended to test whether endowing agents with a good affects their valuation of that good in the context of an experimental auction. By eliciting participants' willingness to pay (WTP) for one unit of a good, two units of a good, and a second unit of a good when they are endowed with the first unit, we show that endowing participants with the first unit has a large and statistically significant effect on WTP for the second unit.

The Endowment Effect and Experimental Auction Valuation

Although authors give various justifications for endowing participants with a good, it seems likely that Shogren et al. (1994) set the precedent by using the endow-and-upgrade approach in their seminal study testing competing explanations for the disparity between consumers' WTP and willingness to accept payment (WTA). In WTP treatments the authors endowed participants with various goods before asking them to bid to upgrade to superior goods in two sets of auction rounds. WTA treatments were similar, except that participants were endowed with the superior product and then asked the minimum payment they would be willing to accept to downgrade to the inferior product.

While the authors may or may not have viewed the endowment approach as superior for estimating the value of the goods up for auction, the primary goal of their study was to test how the endowment effect influenced the disparity between WTP and WTA. Therefore, it was necessary that their participants be given an initial endowment. Other authors interested in estimating the value of new products or product traits have since used the endow-and-upgrade technique, citing Shogren et al. (1994) for support.

For 30 years, economists have been aware that agents typically value a good more highly if it is already in their possession.[3] Thaler was the first to formalize this concept, using prospect theory (Kahneman and Tversky) to explain a number of "economic mental illusions," including the endowment effect. Tversky and Kahneman go on to use prospect theory to explain loss aversion, a situation where potential losses figure more prominently in the agent's mind than do potential gains. The authors then demonstrate how loss aversion can lead to the endowment effect. Today, loss aversion is widely held to be the root cause of the endowment effect.[4]

Munro and Sugden offer the most current theoretical treatment of reference-dependent preferences, presenting a framework which they argue performs as well as

Tversky and Kahneman's in terms of explaining the anomalies described by Kahneman, Knetsch, and Thaler (1991), but that is also more consistent with neoclassical consumer theory. The authors find what they call a "reflexive optimum," a bundle of goods that is optimal to consume when the consumer is endowed with that bundle. An economy has allocated resources efficiently when each individual is consuming at his or her reflexive optimum.

Given the attention that the endowment effect has received in the behavioral literature, there has been surprisingly little attention paid to the effect initial endowments might have on experimental auction results. A notable exception is Lusk, Feldkamp, and Schroeder's examination of whether endowing participants with a generic steak and then asking them to bid to upgrade to a premium steak yields different results than asking participants bid on the two steaks separately. Their results are ambiguous in that the sign and the magnitude of the endowment effect depend on the auction mechanism used. As we will argue later in this article, this ambiguity might be expected given that the effects of loss aversion are confounded by other effects arising from the initial endowment. This is why we have carefully designed our experiment to eliminate the possibility of loss aversion.

Experimental Design

Ninety-four undergraduate students at Iowa State University participated in this experiment in June 2002. The participants bid on combinations of the following three food products in a series of 25 rounds: a 16-ounce jar of salsa, an 8-ounce bag of tortilla chips, and an 8-ounce bag of tortilla chips labeled "Made in America from American ingredients."[5] We chose these specific products because we believed participants were likely to be familiar with them. To ensure that our results were not simply an artifact of the auction mechanism used, we varied the auction mechanism across treatments. In the first treatment, participants bid on goods using the second-price, sealed-bid auction (Vickrey). In the second treatment, participants bid on goods using the random *n*th-price auction (Shogren et al. 2001).[6]

The experiment included seven steps. In Step 1, participants arrived, completed a consent form, and were paid $5 for participating.[7] In Step 2, participants were given written and oral instructions on the auction mechanism to be used in that treatment. They then took a short quiz on the specific details of the auction mechanism. Because our primary interest was not the performance of the auction mechanisms themselves, but understanding how initial endowments affect value estimates, we explicitly told participants that it would be in their best interest to bid their true value. In Step 3, participants took part in a series of three practice auctions in order to ensure that they understood both the auction mechanism and the format of the upcoming rounds—that the auction would involve several rounds, that in some rounds they would be bidding to upgrade from one good to two, and that only one round would be binding.[8] In Step 4, participants were given the chance to examine the three food products for sale in the auction. Depending on the experimental unit, they began by bidding in either Session A or Session B. Session B differed from Session A in that all participants would be endowed with a good if a round from Session B was chosen as binding. In both sessions the order that participants bid on the food products was randomized to reduce any potential order effects.[9, 10] In Step 5, participants bid in Session A or Session B, whichever session they did not bid in during Step 4. In Step 6, the monitor announced the binding round. If the binding round was from Session B, the good was distributed at this point in the experiment. The monitor then determined the market price and winning bidder(s) from the binding round and executed any transactions. In Step 7, all participants completed a questionnaire eliciting background and demographic information. This concluded the experiment. The complete set of instructions given to participants is available from the authors upon request.

In most experimental auction studies, participants are endowed with a basic good (e.g., an ordinary sandwich) and submit bids to upgrade to a superior good (e.g., a sandwich that has been screened for foodborne pathogens). Consequently, winning the auction necessarily involves losing the basic good. Our goal in this study is to analyze the effects of initial endowments *in the absence of loss aversion*, thus we deviate from this conventional design in that we compare the value of a basic bundle (e.g., one jar of salsa) with a superior bundle (e.g., two jars of salsa). By eliminating the potential for loss, we eliminate any loss aversion. As our results will show, this gives us unique insight into the impact initial endowments have on WTP bids in experimental auctions.

Results

In the absence of income or endowment effects, we would expect a participant's WTP to upgrade from one unit of a good to two units of the same good to be equal to the difference in that participant's WTP for two units and his WTP for one unit. That is,

(1) $$WTP_{1\to 2} = WTP_{0\to 2} - WTP_{0\to 1}.$$

We take an initial look at the data by comparing mean bids across rounds. We then report the results of a random-effects Tobit model that takes into account the panel nature of our data.

Table 1 shows the mean bids for each of the three food products. Comparing the figures from the fourth and fifth columns reveals that equation (1) fails to hold. The mean bids to upgrade are 61 to 75% greater than the difference between the mean bids for one and two units. These results are statistically significant at the 0.01 level (using either a *t*-test or a Wilcoxon signed-rank test). To our knowledge, no previous study has shown that endowing experimental auction participants with a good leads them to submit higher bids for subsequent units of that same good.[11] Indeed, the mean bids for the second unit of each good when endowed with the first unit are 29 to 41% greater than the mean bids for the *first* unit in the absence of endowment. These results are also statistically significant at the 0.01 level (again using either a *t*-test or a Wilcoxon signed-rank test).

Table 2 reports the results of a random-effects Tobit regression where the dependent variable is participant *i*'s WTP for the second unit of each good both in the presence and the absence of an initial endowment. Consistent with the results from table 1, we find that initial endowments have a positive and statistically significant impact on bids, suggesting that initial endowments affect value estimates even in an environment that does not present the potential for loss aversion. We also find that the effect is larger in an *n*th-price auction. As mentioned earlier, Lusk, Feldkamp, and Schroeder also find that initial endowments affect bids differently depending on the auction mechanism used. Finally, we find that participants tend to submit higher bids in treatments where they begin by bidding in endow-and-upgrade rounds, and in *n*th-price treatments. Huffman et al. also find that the ordering of sessions significantly influences bids. Similarly, Lusk, Feldkamp, and Schroeder find that bids elicited in an *n*th-price auction are significantly different from second-price auction bids. However, they find that *n*th-price bids are significantly lower, which is the opposite of our result.

In order to mitigate the effects of bidder fatigue, we followed Shogren et al. (1994) and limited the total number of rounds in our experiment to 25. There has been a vibrant debate in the experimental auction literature about the saliency of results from studies where participants bid in multiple rounds (e.g., Harrison 1989, 1992; Cox, Smith, and Walker; Friedman; Kagel and Roth; Merlo and Schotter). With regards to the saliency of our results, we note that our primary result is consistent and highly statistically significant across goods, auction mechanisms, and the ordering of rounds and sessions. We also note that in order to help ensure accurate bids, we explicitly told participants that bidding their true value was their best strategy. As discussed in Merlo and Schotter, participants who know their optimal strategy are less likely to deviate from that strategy.

Reconciliation with Neoclassical Consumer Theory

The most orthodox theoretical explanation of our results would be to attribute the increase in WTP in endowment rounds to an income effect. This, however, is not consistent with our results. The mean monthly disposable income from our sample was \$230.85, while the mean bid for one bag of plain-labeled chips was \$0.51 or 0.22% of monthly income. Given that endowing participants with the first bag of plain-labeled chips led, on average, to a \$0.28 increase in willingness to pay for the second bag (see table 1), this suggests that a 0.22% increase in income led to a 64% increase in the mean bid for a second bag of plain-labeled chips. The resulting income flexibility ($\eta = \%\Delta WTP / \%\Delta Income = 290$) is implausibly large given that Seale, Regmi, and Bernstein find income elasticities for food products typically range from 0.1 to 1.16, which implies a maximum income flexibility of 10.

In the remainder of this section we consider two alternative explanations that may reconcile our results with neoclassical consumer theory. First, it is possible that the endowment effect observed in our study is attributable to a "top-dog effect" where participants derive added benefit from being declared the winner of an auction (Shogren and Hayes). Suppose that no matter which round is chosen as binding, an auction participant derives some fixed degree of added utility from winning for winning's sake, and that that additional utility can be expressed in dollar terms as $w > 0$. Let $a \geq 0$ be the value the participant associates with the first unit of some good, and let $b \geq 0$ be the value he associates with the second unit. We can then denote the participant's WTP for one unit as $WTP_{0\to1} = a + w$, his WTP for two units as $WTP_{0\to2} = a + b + w$, and his WTP to upgrade to two units if he is endowed with the first as $WTP_{1\to2} = b + w$.

In a demand-revealing auction where the researcher endows participants with one unit of a good and then asks them to submit bids to upgrade to a second unit, the estimated value of the second unit would be $WTP_{1\to2} = b + w$. On the other hand, in an auction experiment where the researcher asks participants to submit bids for one unit and two units in different rounds with the understanding that only one of the rounds will be chosen as binding, the estimated value of the second unit would be $WTP_{0\to2} - WTP_{0\to1} = b$. If the top-dog effect is present, we would then expect the endow-and-upgrade approach to overestimate the value of the second unit. Note that here we are assuming that w is a constant. If w is instead increasing and concave in the private value of the bundle being bid on, the separate-bids approach reduces the size of the top-dog effect but does not completely eliminate it.

The previous evidence on the existence of a top-dog effect has been mixed. Shogren and Hayes report that nearly 90% of participants in an induced-value auction market submitted bids that were less than or equal to their assigned value. The authors conclude that these results are not consistent with the existence of a top-dog effect. This contrasts with Kagel's review of the induced-value, second-price auction literature, where he finds that the mean bid in such auctions is generally *greater* than what theory predicts. Such overbidding can also be seen in more recent studies such as Cherry et al. (2004).

Our test is unique in that by focusing on the disparity between willingness to pay to upgrade from one unit to two (i.e., $WTP_{1\to2}$) and the difference between willingness to pay for two units and one unit (i.e., $WTP_{0\to 2} - WTP_{0\to 1}$), we are able to use goods with homegrown values instead of induced values for hypothetical goods. This test is more relevant to the agricultural/food valuation literature because that literature focuses almost exclusively on goods with homegrown values (e.g., Hayes et al.; Alfnes and Rickertsen).

An alternative explanation would be to attribute the observed endowment effect to feelings of "reciprocal obligation." As Rabin (p. 1281) observes, "If somebody is being nice to you, fairness dictates that you be nice to him." Charness and Rabin develop a theoretical model of reciprocity where individual *i* measures his welfare as a weighted average of his own payoff and a social welfare function. The weight placed on other individuals' payoffs in this social welfare function varies depending on individual *i*'s beliefs regarding how well he is being treated by each of those individuals. The model can be used to explain both "positive reciprocity" where an individual sacrifices his own payoff in order to increase the payoff of other individuals who he feels have helped him, and "negative reciprocity" where an individual sacrifices his own payoff in order to decrease the payoff of other individuals who he feels have wronged him. While the authors find no convincing evidence of positive reciprocity in an experimental test, McCabe, Rigdon, and Smith find that second players in a two-player sequential game are significantly more likely to choose a cooperative [$25, $25] outcome over a defection [$15, $30] outcome if they are made aware that the first player passed up a [$20, $20] outside option. Applied to an experimental auction setting, Charness and Rabin's model would predict that participants in an endow-and-upgrade auction would tend to submit higher bids than participants in a separate-bids auction, because the endow-and-upgrade participants may wish to repay the experimenter for the initial endowment.

If we denote this desired reciprocity payment as $r > 0$, a participant endowed with one unit and offered the chance to upgrade to a second unit would submit a bid $WTP_{1\to2} = b + r$. In contrast, a participant asked to submit separate bids for one unit and two units would feel no such reciprocal obligation. In this latter case, the researcher would estimate the value of the second unit to be $WTP_{0\to2} - WTP_{0\to1} = b$. If a reciprocal-obligation effect is present, we would then also expect the endow-and-upgrade approach to overestimate the value of the second unit.[12]

Figure 1 depicts the relationship between WTP bids under the top-dog and reciprocal-obligation specifications. The results from table 3 cast light on the relative fit of the top-dog and reciprocal-obligation WTP specifications. For the top-dog specification we use the mean bids reported in table 1 to estimate a, b, and w as follows:

(2) $a = WTP_{0\to2} - WTP_{1\to2}$,

(3) $b = WTP_{0\to2} - WTP_{0\to1}$,

(4) $w = WTP_{1\to2} - WTP_{0\to2} + WTP_{0\to1}$.

For the reciprocal-obligation specification, we estimate b and r in the same way we estimated b and w above, but we estimate a as $a = WTP_{0\to1}$.[13] Note that the results in table 3 show that under the top-dog specification a is less than b for all three goods. The opposite is true under the reciprocal-obligation specification. Thus, if we assume that the demand curves for chips and salsa are downward sloping, the reciprocal-obligation specification would seem to better describe the aggregate data.

To get a better feel for the relative fit of the two specifications, we also look at individual WTP bids. Table 4 shows that for each of the three goods, our estimates of *w* and *r* are positive for roughly half of participants, and are nonnegative for at least 81% of participants. However, under the top-dog specification the corresponding estimates of *a* are greater than or equal to the estimates of *b* for at most 60% of participants. Under the reciprocal-obligation specification at least 85% of participants submitted bids such that the resulting estimates of *a* are greater than or equal to *b*.

Table 5 reports the results of a random-effects probit analysis testing whether *a* is more likely to be less than *b* under the top-dog specification, where the dependent variable is a dummy equaling one if *a* is less than *b*. These results show that top-dog estimates of *a* are significantly more likely to be less than *b*, which is consistent with the figures reported in tables 3 and 4. Thus, while theory suggests that either the top-dog effect or reciprocal obligation could contribute to the endowment effect observed in experimental auctions, our results are more consistent with reciprocal obligation.

Given that participants endowed with a product become somewhat wealthier, it is also possible that the observed disparity between $WTP_{1\to 2}$ and $\left(WTP_{0\to 2} - WTP_{0\to 1}\right)$ could be attributed to a large windfall-gain effect. Empirical work focusing on windfall gains in non-auction laboratory experiments has produced mixed results. Clark, for example, finds no evidence of windfall effects when comparing voluntary contributions to a group fund made by participants who did and did not receive an initial cash endowment.

Forsythe et al., on the other hand, find that in a simple non-hypothetical dictator game more than 20% of participants offer up at least half of their windfall income. Hoffman, McCabe, and Smith show that this result is sensitive to procedural and instructional variations. In particular, they find that in a double-blind experimental setting, fewer than 5% of participants offer up at least half of their windfall. And most recently, Cherry, Frykblom, and Shogren find that participants dividing windfall income are significantly more generous than those dividing earned income. While none of the participants in their study were willing to part with more than half of their income, more than 20% of those receiving a $10 windfall offered up $5. One constant across all of these dictator games, though, is that the mean offer is well below half of the windfall. For each of the three goods in our study, we find that endowing participants with the first unit of a good leads to an increase in mean WTP for the second unit equal to at least 52% of mean WTP for the first unit in the absence of endowment. Defining the average windfall in the endow-and-upgrade rounds as the mean WTP for the first unit, it is highly unlikely in light of the above mentioned empirical studies that endowment effects of this size are attributable to windfall gains alone. However, reciprocal obligation could be thought of as a variation on windfall gains, where participants wish to share their windfall with the experimenter.

Our results give new insight into the results of the only other published study that has attempted to determine the effect of initial endowments on experimental auction results. Lusk, Feldkamp, and Schroeder estimate the premium consumers place on various grades of beefsteak, using both the endow-and-upgrade and separate-bids methods. Interestingly, the authors find a statistically significant endowment effect for the random *n*th-price auction mechanism, no significant effect for the English and BDM auction mechanisms, and a significant "reverse endowment effect" for the second-price auction mechanism. We believe that this ambiguity may be an artifact of the experiment's design. Specifically, the authors compare the value of a generic steak and a premium steak. In the endow-and-upgrade treatments, winning bidders would have to give up the steak they were endowed with in order to exchange it for a premium steak. In this context, loss aversion would motivate these participants to bid less, while reciprocal obligation and/or the top-dog effect would motivate them to bid more. The net effect is ambiguous. In our study, participants bid to upgrade from one unit of a good to two units of that same good, thereby eliminating the possibility of loss and any potentially confounding loss aversion.

Further research is necessary in order to better understand the magnitude of the biases associated with initial endowments, and how and why they are affected by the choice of auction mechanism. Future research that can test for the existence of the top-dog and reciprocal-obligation effects in isolation would also be interesting.

Conclusions and Implications

In this article we show that endowing auction participants with a good significantly affects their valuation of that good even in the absence of loss aversion. We also postulate two alternative explanations of our results that are consistent with neoclassical consumer theory. The first is that participants derive some psychic benefit from being top dog (i.e., from being declared the winner of an auction). The second is that participants endowed with a good wish to repay the experimenter by submitting a higher bid. We find that this second explanation does a better job describing our auction participants' bidding behavior.

The results presented in this article have important implications for the agricultural/food safety valuation literature. In dozens of valuation studies, researchers have endowed experimental participants with a bundle and then asked the participants how much they would be willing to pay to exchange the bundle they were endowed with for a different (and presumably superior) bundle. Our findings raise questions about the accuracy and validity of the results in these articles. We have shown that participants' WTP changes significantly when they are endowed with a good. As a result, participants' bids to upgrade cannot strictly be interpreted as the premium they place on the second bundle relative to the first because that value estimate is likely biased by the initial endowment. Further, because loss aversion would have the opposite effect of reciprocal obligation, researchers will not know the direction of the net bias. In many circumstances, a better method for valuing a particular trait or characteristic would be to calculate the difference between participants' bids from two distinct, potentially binding auction rounds, one where participants bid on a good possessing the trait of interest and one where they bid on a good that does not (e.g., Rousu et al.). Not only would this technique eliminate any endowment effect, it would also be more consistent with the market environment participants are likely to encounter outside of the experimental auction.

We recognize, however, that there are circumstances where the endow-and-upgrade method may be warranted. First, when using the endow-and-upgrade approach, the researcher can impose a consumption requirement where, for example, participants are required to eat either the food product they were endowed with or the one that they have paid to upgrade to (e.g., Shogren et al. 1994). The benefit of this requirement is that it ensures that the bid price represents bidders' own consumption value, not the value they associate with giving the good to someone else or selling it outside of the experiment. And given that bids are censored at zero, the consumption requirement can also be used to elicit the premium bidders place on the novel trait, even if the value they place on each good individually is negative.

Second, the endow-and-upgrade approach may eliminate problems arising from the availability of outside substitutes. Kolstad and Guzman; and Harrison, Harstad, and Rutström argue that if a good can be purchased outside of the experimental auction, WTP bids will be censored from above at or near the good's outside market price *p*. Cherry et al. (2004) find this to be the case in induced-value auctions, while Corrigan finds that bids for a good with homegrown value are affected by participants' beliefs regarding the relative difficulty of buying or selling the good outside of the experimental auction. Therefore, if auction participants are bidding separately on two products, a novel good that is not available outside of the experimental market and a conventional good that is, participants' bids for the conventional good may be censored at or near *p*, resulting in an overestimate of the premium placed on the novel good.

While endowing participants with the conventional good and eliciting bids to upgrade to the novel good would avoid these potential biases, our results suggest that the initial endowment would introduce a bias of its own. Researchers must be mindful of the sign and the magnitude of potential biases, and should design experimental auctions accordingly. This is especially important in regards to the design of hypothesis tests. Rejecting the null hypothesis H_0: $\$X = 0$ in favor the alternative hypothesis H_A: $\$X > 0$ is meaningless if we know that $\$X$ is biased upward.

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	Top-Dog Specification	Reciprocal-Obligation Specification
Bid for one unit	$WTP_{0\to1} = a + w$	$WTP_{0\to1} = a$
Bid for two units	$WTP_{0\to2} = a + b + w$	$WTP_{0\to2} = a + b$
Bid to upgrade from one unit to two units	$WTP_{1\to2} = b + w$	$WTP_{1\to2} = b + r$

Figure 1. Top-dog and reciprocal-obligation willingness-to-pay specifications

Table 1. Mean Bids (*N* = 94)

	Mean Bid for One Unit	Mean Bid for Two Units	Mean Difference in Bids for One and Two Units	Mean Bid to Upgrade from One to Two Units
Plain-Labeled Chips	$0.51 (0.51)[a]	$0.95 (1.00)	$0.44 (0.55)	$0.72** (0.83)
American-Labeled Chips	$0.58 (0.56)	$1.07 (1.06)	$0.49 (0.58)	$0.79** (0.94)
Salsa	$0.65 (0.57)	$1.13 (1.07)	$0.48 (0.60)	$0.84** (0.94)

[a] Standard deviations in parentheses.
** Mean values reported in the fourth and fifth columns are significantly different at the 0.01 level.

Table 2. Random-Effects Tobit Regression Results (*N* = 564)[a]

Variable	Coefficient Estimate
Constant	0.181
	(0.193)[b]
Bid submitted in an endow-and-upgrade round	0.344**
	(0.036)
Bid submitted in an endow-and-upgrade round using the random *n*th-price auction.	0.186**
	(0.059)
Participant bid in a random *n*th-price auction treatment	0.234*
	(0.106)
Participant bid in endow-and-upgrade rounds first	0.199*
	(0.092)
Bid submitted for plain-labeled chips	-0.104
	(0.068)
Bid submitted for American-labeled chips	-0.024
	(0.073)
Female	0.010
	(0.085)
Age	-0.006
	(0.008)
Monthly income (hundreds of dollars)	0.026
	(0.019)
Log likelihood	-489.76

[a] The dependent variable is participant *i*'s bid for the second unit of a good.
[b] Standard errors in parentheses.
* Significant at the 0.05 level.
** Significant at the 0.01 level.

Table 3. Mean Value Estimates Under Top-Dog and Reciprocal-Obligation Specifications

	Top Dog		
	a	*b*	*w*
Plain-Labeled Chips	$0.23	$0.44	$0.28
American-Labeled Chips	$0.28	$0.49	$0.30
Salsa	$0.29	$0.48	$0.36

	Reciprocal Obligation		
	a	*b*	*r*
Plain-Labeled Chips	$0.51	$0.44	$0.28
American-Labeled Chips	$0.58	$0.49	$0.30
Salsa	$0.65	$0.48	$0.36

Table 4. The Percentage of Participants Whose Bids Are Consistent with Theory

	Top Dog		
	$w > 0$	$w \geq 0$	$a \geq b$
Plain-Labeled Chips	49%	83%	60%
American-Labeled Chips	49%	81%	56%
Salsa	62%	83%	52%

	Reciprocal Obligation		
	$r > 0$	$r \geq 0$	$a \geq b$
Plain-Labeled Chips	49%	83%	90%
American-Labeled Chips	49%	81%	85%
Salsa	62%	83%	90%

Table 5. Random-Effects Probit Regression Results (N = 564)[a]

Variable	Coefficient Estimate
Constant	-2.278**
	(0.863)[b]
Top-dog specification	1.402**
	(0.107)
Participant bid in a random *n*th-price auction treatment	0.246
	(0.288)
Participant bid in endow-and-upgrade rounds first	0.198
	(0.332)
Bid submitted for plain-labeled chips	-0.199
	(0.198)
Bid submitted for American-labeled chips	0.001
	(0.184)
Female	0.110
	(0.264)
Age	0.030
	(0.039)
Monthly income (hundreds of dollars)	-0.057
	(0.065)
Log likelihood	-265.18

[a] Dependent variable = 1 if $a < b$.
[b] Standard errors in parentheses.
* Significant at the 0.05 level.
** Significant at the 0.01 level.

Notes

[1] Examples include Alfnes and Rickertsen; Buhr et al.; Dickinson and Bailey; Fox; Fox, Hayes, and Shogren; Fox et al. (1994, 1995); Hayes et al.; Lusk et al. (2001a, 2001b); Shogren, List, and Hayes; and Shogren et al. (1994).

[2] See Kahneman, Knetsch, and Thaler (1991) for a nice review.

[3] See Becker, Ronen, and Sorter; and Neumann and Friedman for early empirical evidence of this phenomenon.

[4] Referring to the endowment effect, Kahneman, Knetsch, and Thaler (1990, p. 1326) state that "this effect is a manifestation of loss aversion." According to Morrison (p. 189), "the endowment effect proposes that people value goods more highly once they own them—perhaps the result of a sort of loss aversion."

[5] Although participants bid on these items in multiple rounds, two features differentiate our auction from a repeated trial auction with posted prices. First, participants bid on a different bundle of goods in each round. Second, prices were not posted between rounds, so participants' bids were not influenced by the bids submitted by other participants in previous rounds. Therefore, we do not run into the pitfalls of bid price affiliation that can occur in repeated trial auctions (List and Shogren; Corrigan and Rousu; Harrison, Harstad, and Rutström).

[6] Both of these auction mechanisms are demand revealing (i.e., bidding one's true value is a weakly dominant strategy). In the second-price auction, all bidders submit a sealed bid, and the top bidder wins the auction and pays the second highest price. The random *n*th-price auction differs only in that after the monitor ranks the bids from highest to lowest, he randomly selects a number between 2 and N (where N is the number of participants), and the corresponding bid becomes the *n*th price. The $n - 1$ bidders who submitted bids higher than the *n*th price then purchase the product paying the randomly selected *n*th price.

[7] Recent studies have shown that the size of the cash payment that participants receive (Loureiro, Umberger, and Hine) and the manner in which it is provided to them (Cherry, Frykblom, and Shogren) can impact experimental results. To be consistent with other experimental auction studies, our participants did not have to perform any preliminary task to earn their participation fee. Because any wealth/windfall

effects from the participation fee would affect the bids submitted in all rounds, this should have no qualitative effect on our results. However, this would certainly be an extension worth pursuing.

[8] Rousu explains that randomly selecting one binding round gives participants an incentive to bid their true value and prevents bid reduction from demand curve effects, while Lusk, Feldkamp, and Schroeder observe that bidding truthfully is the dominant strategy so long as participants' expected utilities are linear in probabilities. Roosen et al. find that results from this type of auction are statistically similar to those from a single-shot auction.

[9] For evidence on how ordering matters in experiments, see Huffman et al..

[10] The results from several of the rounds of bidding in this experiment are not reported in this article. They are being used for a separate project to estimate demand flexibilities using auction data.

[11] The addiction and habit formation literature does show that previous behavior or endowments can increase the value agents place on goods (e.g., Becker and Murphy; Becker, Grossman, and Murphy).

[12] In order to test whether *r* is an increasing function of the value bidders place on the first unit of a good, we use fixed-effects analysis to estimate *r* as a linear function of *a*, controlling for individual-specific effects and the good being bid upon. We find that the coefficient associated with *a* is positive and significant at the 0.05 level. This is intuitively appealing. The more generous the endowment, the more obliged we would expect the bidder to feel.

[13] If the participation fee increased *a* and *b* to by some constant proportion $\gamma \geq 1$ (e.g., $WTP_{0\to 2} = \gamma a + \gamma b$ under the reciprocal-obligation specification), this would have no impact on the mean values for *r* and *w* reported in table 3.