

Experimental tests of the endowment effect¹

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Abstract

The endowment effect, which predicts undertrading and a willingness-to-accept greater than willingness-to-pay, is studied using responses that remove all reference to buying or selling and focuses only on choice tasks. The results significantly lower the willingness-to-pay/willingness-to-accept discrepancy, but the latter is still significant. A high efficiency open display uniform price auction is used to exchange mugs for money. Since mugs are randomly assigned to half of $2N$ subjects, $N/2$ mugs are predicted to trade. Less than $N/2$ mugs trade on average, but more than previously reported. The phenomenon exists but is less prominent than reported previously.

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1. Introduction

1.1. The endowment effect

Individual decision-making studies have shown that human subjects reveal an asymmetric response pattern toward losses (loss aversion) as contrasted with gains measured relative to any individual's initial status quo position (Kahneman and Tversky,

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1979). Consequently, if one's initial wealth endowment is X_0 , then the hypothesis is that the utility function, $u(\cdot)$, has the property that $u'(X_0 - \Delta X) > u'(X_0 + \Delta X)$ for all deviations ΔX from any initial X_0 . Although Kahneman and Tversky (1979) were concerned with prospect theory as a modification of utility theory for risky decision, in a fundamental extension Thaler argued that "many of the elements of prospect theory can be used in developing descriptive choice models in deterministic settings" (Thaler, 1980, p.41). Thaler observed that the utility property, $u'(X_0 - \Delta X) > u'(X_0 + \Delta X)$ implies that out-of-pocket costs are more heavily weighted in utility assessments than opportunity costs; i.e. a forgone gain has lower utility value than the actual loss of the same amount. This cognitive underweighting of opportunity costs by the individual was referred to as the "endowment effect," and was used to explain a number of questionnaire survey examples.

Subsequently, Kahneman et al., 1991 (KKT) suggested that the discrepancy between willingness-to-pay (WTP) and willingness-to-accept (WTA), widely observed in hypothetical surveys and in motivated exchange experiments, were all manifestations of the endowment effect. (See KKT, Table 1 for a summary.) However, they argue (KKT, p.1327) that the endowment effect does not apply when goods are purchased for resale rather than use. Thus there is no endowment effect for the retail firm, only for the consumer purchasing the firm's goods. Similarly, they note that it does not apply to the exchange of tokens (or rights) to which private redemption values, or induced values, have been assigned by the experimenter (Smith, 1976). Empirically, they show this to be approximately the case in experiments establishing an endowment effect for Cornell and other coffee mugs but not for induced value tokens.

The results of nine experiments are reported by KKT. Some of these were exchange experiments, others were choice experiments using the (Becker et al., 1964) procedure. In Section 1 we discuss their choice experiments, introduce our modifications in their procedures, and present the new results. We replicate their procedures in pure choice experiments by removing all references to 'buying' and 'selling.' The purpose is to remove all differential strategic motivation that might be suggested by these terms. In Section 2 we discuss their exchange experiments and present the results of 10 new exchange experiments using the uniform-price double-auction mechanism which, because of its real time information feedback features, achieves high efficiency in single-period exchange.

2. Choice tests of the endowment effect

2.1. The KKT experiments

In their typical choice experiment half of a group of subjects are randomly designated sellers and the others buyers. University coffee mugs costing about \$6 in the local University bookstore, are then distributed to the sellers, and all buyers are given the opportunity to examine a mug. The following forms are then executed by all sellers [buyers] (see KKT, p.178 for their instructions).

	I will sell	I will keep
	[buy]	[not buy] the mug
If the price is \$0	_____	_____
If the price is \$0.50	_____	_____
.....		
If the price is \$9.50	_____	_____

For example, on this form a seller might indicate a preference for keeping the mug for all prices at or below \$5.00, selling it at all prices above \$5.00. The subject's WTA would then be assessed at \$5.25.

After the forms were executed an equally likely price was drawn from the list between \$0 and \$9.50, and exchanges based on this price were conducted by the experimenter.² The results of their experiment 5 were typical of those reported by KKT: The median selling price, \$5.75, is more than double the median buying price, which is consistent with an endowment effect. But, as recognized by KKT, this interpretation is clouded by the fact that the experiment did not control for the income effect in standard preference theory.

To address this objection KKT (pp.179,180) use *three* groups instead of two: sellers, buyers and choosers. The sellers/buyers make the same sales/purchase decisions as before, while the choosers are asked to choose at each prospective price between the mug or cash. Thus sellers are given a mug, and choosers are given the right to either a mug or cash as they choose; any income effect on sellers as distinct from buyers, should also apply to choosers.

KKT report median prices for the three groups for each of the two experiments (KKT, experiments 6 and 7, pp.179,180). Mean prices for their data are shown in the first row of Table 1: choosers behave much more like buyers than sellers, although choosers value mugs sixty percent more highly than buyers.

Table 1
Mean WTA and WTP for university emblem mugs

Experiment	WTA sellers	WTP buyers	WTA choosers	WTA-S/ WTP-B	WTA-S/ WTA-C	Sample size, <i>N</i>
KKT 6 ^a and 7 ^b	\$6.89	\$1.91	\$3.05	3.61	1.60	194
	WTA Group 1	WTP Group 2	WTA Group 3	WTA-1/ WTP-2	WTA-1/ WTA-3	
UofA ^c	\$5.36	\$2.19	\$3.88	2.45	1.38	120

^a Mugs and subjects from Simon Fraser University.

^b Mugs and subjects from University of British Columbia. Price tags were left on the mugs.

^c Mugs and subjects from University of Arizona. All subjects make choices: In Group 1, each is endowed with a mug; Group 2, each is endowed only with the money earned in a pre-experiment; and Group 3, each is endowed with the right to choose either a mug or additional money.

²In some experiments the ordered individual WTPs and WTAs are crossed and the exchange is directly between buyers and sellers at a common clearing price. But in these cases it is no longer true "that your decision can have no effect on the price..." as stated in the KKT instructions (p.178).

2.2. Choice experiments controlling for differential instruction effects

Since it was these last two experiments that were critical to the hypothesized endowment effect, we conducted four experiments each with 24 subjects (8 in each group); motivated by the three-group design. However, we made several instructional changes which, we conjectured, might be of substance.

Psychologically, 'buying', 'selling' and 'choosing' are distinct emotive terms. The first two are laden with strategic connotations – buyers are motivated to buy low, sellers to sell high – while 'choosing' appears to be not so laden. To control for effects due only to differences in the KKT wording of the tasks for each of the three groups of subjects we neutralized our instructions so that each group was presented with a choice task, not 'buying,' 'selling' and 'choice' tasks. Our instructions, common for all subjects, and the choice sheet for each of the three groups, now referred to with antiseptic evenness as Group 1, Group 2, and Group 3, are shown in an appendix supplied on request. Each member of Group 1 is an owner of an Arizona Wildcat Mug, and their task is to choose, for each amount of money (*not* a 'price'), between retaining their mug, or accepting the additional amount of money. Each member of Group 2 is designated as having the right to choose between accepting a mug or retaining an amount of money out of their earnings in a previous experiment in the same session. Finally, each person in Group 3 is designated as having the right to choose between accepting a mug or accepting an additional amount of money. Thus, all subjects are symmetrically described as choosers, but under different initial conditions.

All of our experiments were run at the end of two simultaneously posted offer market experiments (6 buyers, 6 sellers in each), reported in Franciosi et al. (1994). The positions of Groups 1, 2 and 3 were assigned at random among the 24 subjects. All subjects were paid their earnings in cash at the end of the market experiments. Earnings ranged from \$8.75 to \$44.50, providing all Group 2 subjects with adequate funds to give up for a mug if they chose.

The mean monetary amounts ('prices') for each of Groups 1, 2 and 3 are shown in the second data row of Table 1. The mugs were priced at \$9.95 (price tags removed) in the campus bookstore.

From Table 1 our subjects reported a substantially lower Group 1, WTA, a somewhat higher WTP, and a higher Group 3, WTA, than did the KKT subjects. Substituting a choice task for the buying and selling tasks appears to narrow substantially the WTA/WTP discrepancy. But from Table 2 row 1, the *t*-test shows that all pairwise comparisons of our three groups come from different distributions. Row 2 compares the KKT results with ours and shows that the reduction in selling prices and the increase in buying prices are significant using the Wilcoxon test. Since these comparisons did not control for differences due to subjects and experimenters, we cannot attribute them only to the treatment differences.

We also asked if being in the role of buyer or seller in the prior market experiments affected the value revealed for a mug. The effect was insignificant using the Epps–Singleton test ($\alpha=0.37$). Finally, we asked if the amount paid to subjects in the prior market experiments affected their revealed values in the mug experiment. A regression of

Table 2
Group distribution differences and comparisons with KKT results for Buyers, Sellers and Choosers using *t*-tests

Hypotheses	G1=G2	G2=G3	G3=G1
Group 1-3	$t=7.33$ $\alpha=0.000$	$t=-4.01$ $\alpha=0.000$	$t=-2.98$ $\alpha=0.004$
KKT S, B and C Groups	G1=S $t=-3.73$ $\alpha=0.00$	G2=B $t=1.10$ $\alpha=0.27$	G3=C $t=2.12$ $\alpha=0.04$

the latter on the former yielded no significant relationship ($R^2=0.007$). This suggests that any 'house money' income effect on mug valuation is nil (Thaler and Johnson, 1990).

3. Exchange tests of the endowment effect

3.1. The KKT exchange experiments

In addition to their choice experiments, KKT report the results of several exchange experiments. The typical experiment proceeds as follows. Of $2N$ subjects, N are randomly designated buyers, and N sellers. The latter are each endowed with a mug; the former use their own money. Buyers each submit a bid price to buy a mug, sellers each submit an offer price to sell their mug. Their 'bids' or 'offers' are solicited by asking each subject to choose between a price and a mug for a series of prices as in the choice procedure. The bids (WTP's) of the subjects are then ordered from highest to lowest, while the offers (WTA's) are similarly ordered from lowest to highest. The intersection of these reported supply and demand schedules determines the price and quantity exchanged. If there are no endowment or income effects, then due to the random allocation of subjects to the buy or sell category the supply schedule of those given the mugs should be the symmetric mirror image of the demand schedule for those not given the cups; i.e. $(\text{demand}) \equiv D(P^*) = S(P^*) \equiv N - D(P^*)$ and $D(P^*) = N/2$. Consequently, the prediction is that $N/2$ mugs will trade. For example (KKT, pp.170–173), with 44 subjects, and $N=22$ buyers and 22 sellers, 11 mugs are predicted to trade. In fact, between one and four trade at prices between \$4.25 and \$4.75. Although there are several bid/offer trials, only one is chosen at random to be binding. Table 3 summarizes their results for induced value tokens, mugs, and pens for all trials in four experiments.

According to the endowment hypothesis the predicted number of trades will be realized for induced value tokens, since one is simply trading dollars for identical dollar claims: in

Table 3

Experiment	Trial	Number subjects	Object	Price	Observed trades	Predicted trades
1	1	44	Tokens	\$3.75	12	11
1	2	44	Tokens	\$4.75	11	11
1	3	44	Tokens	\$4.25	10	11
1	4	44	Mugs	\$4.25	4	11
1	5	44	Mugs	\$4.75	1	11
1	6	44	Mugs	\$4.50	2	11
1	7	44	Mugs	\$4.25	2	11
1	8	44	Pens	\$1.25	4	11
1	9	44	Pens	\$1.25	5	11
1	10	44	Pens	\$1.25	4	11
1	11	44	Pens	\$1.25	5	11
2	1	38	Tokens	\$3.75	10	10
2	2	38	Tokens	\$4.75	9	10
2	3	38	Tokens	\$4.25	7	8
2	4	38	Mugs	\$1.75	3	9.5
2	5	38	Mugs	\$2.25	3	9.5
2	6	38	Mugs	\$2.25	2	9.5
2	7	38	Mugs	\$2.25	2	9.5
2	8	38	Binoculars	\$1.25	4	9.5
2	9	38	Binoculars	\$.75	4	9.5
2	10	38	Binoculars	\$.75	3	9.5
2	11	38	Binoculars	\$.75	3	9.5
3	1	26	Tokens ^a	—	5	6.5
3	2	26	Pens ^a	—	2	6.5
3	3	26	Pens ^a	—	2	6.5
3	4	26	Pens ^a	—	2	6.5
3	5	26	Pens ^a	—	1	6.5
4	1	74	Tokens ^a	—	15	18.5
4	2	74	Tokens ^a	—	16	18.5
4	3	64	Mugs ^a	—	6	18.5
4	4	74	Mugs ^a	—	4	18.5
4	5	72	Mugs ^a	—	4	18
4	6	73	Mugs ^a	—	8	18
4	7	74	Mugs ^a	—	8	18.5

^a Prices are not reported in experiments 3 and 4. In these experiments “the subjects were asked for minimum selling or maximum buying prices rather than answer the series of ‘yes or no’ questions used in Experiments 1 and 2” (KKT, p.175).

fact, on average there is undertrading (in experiments 2, 3 and 4 but not 1). This is consistent with other studies showing a tendency to underreveal (token) demand and/or supply by subjects in uniform price sealed bid institutions (Smith et al., 1982). But with consumer goods (mugs, pens) there is substantial undertrading – much less than half the

predicted volume is observed to trade.³ If there are income effects, then the demand by subjects not endowed with mugs, $d(P) < D(P)$, the demand by the endowed subjects. Hence $d(P^*) = N - D(P^*) < N - d(P^*)$ and $d(P^*) < N/2$. But our finding reported above, showing no income effect, suggests that this cannot account for the results in Table 3.⁴

We should add that the KKT procedure does produce an incentive to underreveal demand (supply). When subjects are asked to choose between an object and a price, they know that their crossover price is, in effect, a bid price for a buyer and an ask price for a seller. Then “the market price was the point at which the elicited supply and demand curves intersected.” (KKT, footnote 2, p.171). This procedure means that if the highest accepted ask, $A_H < B_L$, the lowest accepted bid, then there are many prices that clear the market. The typical (fair?) procedure is to set the clearing price at $P_C = (A_H + B_L)/2$. The mug price in trial 6 of experiment 1 is an example in which P_C is halfway between the discrete values \$4.25 and \$4.75 on the subject’s choice form. If subjects believe that $A_H < B_L$ is a possible outcome it pays any seller (who may turn out to be the marginal seller) to ‘ask’ more than her WTA (or marginal buyer to ‘bid’ below his WTP). Since the distribution of the consumer good object values is highly uncertain, and unknown to both the subjects and the experimenters, the incentive to misrepresent may be more pronounced than with tokens.

3.2. *The uniform price double auction mechanism*

There exists a trading institution which results in a single block trade called the Uniform Price Double Auction but which has the real time feedback characteristics of the continuous double auction, it has been extensively studied in the laboratory, (McCabe et al., 1993, Friedman, 1991). Bids and offers are displayed in real time, and continuously crossed to yield a provisional clearing price and quantity while the market is open. When the trading period ends, all trades become binding at the price and quantity standing at the close. This institution is particularly well suited for examining the exchange predictions of the endowment effect because it has been shown to have excellent revelation properties for marginal units, resulting in fully efficient exchange.

Table 4 and Fig. 1 illustrate the state of all bid and offer realizations at the market close for a typical trading period in an experiment (period 12, experiment 7302 below). The first column lists the identification number of each buyer, followed by that buyer’s bid (column 2). The rank order (high-to-low of bids, low-to-high of offers) is shown in column 3. Column 4 displays each seller’s offer followed by the seller’s identification number in column 5. The horizontal line below the 6th ranked bid and offer separates the accepted bids and offers above from the rejected bids and offers below the line. The accepted bids and offers form contracts at a uniform price (300¢ in Table 4). Several

³Sometimes it has been suggested that subjects trade in induced value experiments because they think the experimenter expects it and brought them to the lab for this purpose. The KKT results are quite contrary to this interpretation.

⁴One could also use our WTP and WTA data from the choice experiments to determine a hypothetical exchange quantity based upon the BDM elicitation procedures. We performed this exercise by crossing the Group 1 WTA with the Group 2 WTP and found that of 20 predicted trades only 8 would occur. This undertrading is consistent with the findings of KKT. If we use the Group 3 data as a better estimate of ‘true WTA’ and cross these with the Group 2 WTP, we still get only 12 of 20 predicted trades.

Table 4
 Bid, offers and trades uniform price double auction experiment 7302, period 12

ID No.	Bid	Rank	Offer	ID No.
2	400	1	220	19
6	325	2	290	24
9	310	3	300	22
4	310	4	300	21
11	301	5	300	17
12	300	6	300	27
10	311	7	329	25
7	300	8	330	26
1	300	9	347	18
8	280	10	362	23
5	270	11	380	20
3	200	12	—	—

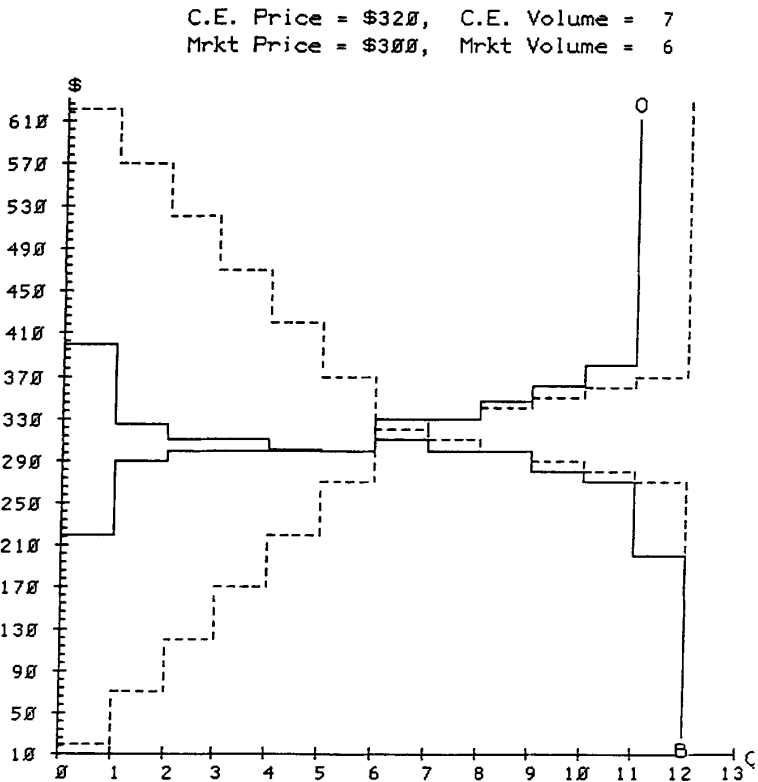


Fig. 1. Graph of induced supply and demand, and of bid/offer realizations UPDA experiment 7302, period 12.

alternative information feedback and price algorithm procedures for this mechanisms have been studied. We use the procedure in which subjects see displayed in real time only the best rejected bid and offer (311 and 329 in Table 4). This places maximum pressure on the outside traders to reach agreement, and has been found to yield the highest exchange volume and market efficiency (McCabe et al., 1993, p.320).

In Fig. 1 the demand bids (supply offers) are plotted as solid line steps. Also plotted, as broken line steps, are the induced value or cost of each trader. Note the substantial value/cost underrevelation, which does not thereby impede the efficient exchange of six units.

3.3. Mug exchange using the uniform price mechanism

We report the results of two series of experiments. In each experiment 24 different subjects were randomly assigned to groups of 12 buyers and 12 sellers. Each series was divided into Parts 1 and 2 (see Table 5). In Part 1 of Series 1 each buyer was assigned a value and each seller a cost by a random draw with replacement from the uniform distribution on [\$0, \$9.99] at the beginning of each of 10 (or 12) trading periods. This baseline served as a training session. All periods lasted 4 minutes. In Part 2, Series 1 and 2, each buyer was endowed with a \$9.99 cash balance which was theirs to keep if no mug was purchased; each seller was endowed with a University of Arizona emblem mug priced at \$9.95 in the University bookstore and was theirs to keep if not sold. Each subject was paid in cash all of his/her earnings from the induced value training experiments in Part 1 of each of the sessions. In series 2, Part 1 used the constant volume equilibrium environment shown in Fig. 1, but in each period a random constant was added to each value, and the values randomly assigned to individuals. Part 2 of series 2 was like that of series 1 except that the price tag (\$9.95) was left on each mug, and this was pointed out to the subjects. This was as a treatment to reduce uncertainty concerning the cash or market value of the mug in each group. Also in series 2 we increased the trading time for the mug exchange from 4 to 6 min in four of the six experiments. This is because it appeared that the subjects were still adjusting their bids and offers when the period ended after 4 min. Table 5 summarizes the experimental design.

Table 5
Description of treatments in exchange experiments

	Series 1	Series 2
Part 1	Induced Values [\$0, \$9.99]; random equilibrium; 4 min periods	Induced Values [\$0, \$9.99]; constant equilibrium; 4 min periods
Part 2	Buyers: \$9.99 Sellers: one mug each; 4 min periods	Buyers: \$9.99 each. Sellers: one mug each; 4 and 6 min periods \$9.95 tag left on mug
Number of Experiments (subjects)	4 (96)	6 (144)

3.4. Results of exchange experiments

Table 6 lists the predicted competitive equilibrium volume, and corresponding observed trading volume in periods 1–10 for the random equilibrium induced value environment. The induced value results are those recorded for periods 1–10 in four experiments. The mug exchange volume is recorded in period 11 for each experiment, with the corresponding clearing price shown in parentheses.

Table 7 lists the volume data for the experiments using a constant equilibrium volume environment for periods 1–12 in the training baseline. Period 13 records the volume in the subsequent mug exchange experiments, with the clearing price shown in parentheses.

In both Tables 6 and 7 as we move from induced value exchange to mug exchange, volume relative to the prediction is decreased. But comparing the mug exchange volume in Tables 6 and 7 with the various objects exchanged in Table 3 it is clear that our exchange mechanism results in much less undertrading than was observed by KKT. In three of our ten experiments half or more of the mugs trade as predicted by standard theory.

Since earnings in the induced value experiments vary from zero to \$34, we can ask if there are any income effects on the submitted bids or offers of subjects in the mug experiments. Separate regressions of such bids (offers) on earnings for buyers and for sellers yield no significant effect of earnings on subject WTP or WTA for a mug (the regression coefficients yield *t*-values of -0.28 for sellers and -0.20 for buyers).

Each mug exchange experiment provides a sample of bid and offer prices standing at the close of each experiment. Since the exchange mechanism provides full opportunity for each subject to adjust his or her bid or offer price to the level needed to produce a

Table 6
Volume traded in exchange experiments series 1, random equilibrium^b

UPDA experiment ^a	5282		6012		7162		7232	
Trading period	Volume		Volume		Volume		Volume	
	predicted	observed	predicted	observed	predicted	observed	predicted	observed
1	8	8	7	6	6	5	5	5
2	7	8	6	5	5	5	6	7
3	6	6	4	4	6	6	6	5
4	8	7	5	5	7	6	7	6
5	4	5	7	6	7	6	7	7
6	6	6	7	6	6	6	5	4
7	7	6	6	5	6	5	5	4
8	6	5	8	7	6	5	6	5
9	5	5	7	7	5	5	5	5
10	7	6	5	4	6	5	6	6
11 ^c	6	6(189¢)	6	3(300¢)	6	3(100¢)	6	4(101¢)

^a Experiment numbers refer to date experiment was conducted, e.g. 5282: May 28, 1992.

^b In each period, 1–10, values were drawn with replacement from the uniform distribution on [\$0, \$9.99].

^c Volume for number of mugs traded in period 11. Price in cents is shown in parenthesis.

Table 7
Volume traded in exchange experiments series 2, constant equilibrium ^a four and six minute mug trading periods

UPDA experiment ^a	7302 ^b		1062 ^b		10152 ^b		01263 ^c		01283 ^c		02193 ^c		02243 ^c	
Trading period	Volume		Volume		Volume		Volume		Volume		Volume		Volume	
	predicted	observed	predicted	observed	predicted	observed	predicted	observed	predicted	observed	predicted	observed	predicted	observed
1	6-7	6	6-7	8	6-7	8	6-7	6	6-7	7	6-7	7	6-7	6
2	6-7	6	6-7	7	6-7	7	6-7	6	6-7	6	6-7	6	6-7	6
3	6-7	6	6-7	8	6-7	6	6-7	7	6-7	7	6-7	6	6-7	6
4	6-7	7	6-7	7	6-7	6	6-7	6	6-7	7	6-7	5	6-7	6
5	6-7	6	6-7	7	6-7	7	6-7	6	6-7	7	6-7	7	6-7	6
6	6-7	6	6-7	6	6-7	6	6-7	6	6-7	6	6-7	6	6-7	6
7	6-7	6	6-7	6	6-7	6	6-7	7	6-7	7	6-7	6	6-7	6
8	6-7	6	6-7	6	6-7	5	6-7	6	6-7	7	6-7	6	6-7	6
9	6-7	6	6-7	6	6-7	7	6-7	7	6-7	6	6-7	6	6-7	6
10	6-7	6	6-7	6	6-7	7	6-7	7	6-7	6	6-7	6	6-7	7
11	6-7	7	6-7	7	6-7	6	6-7	6	6-7	6	6-7	6	6-7	6
12	6-7	6	6-7	6	6-7	6	6-7	6	6-7	6	6-7	6	6-7	6
13 ^b	6	2(223¢)	6	7(143¢)	6	3(250¢)	6	6(350¢)	6	5(85¢)	6	3(452¢)	6	3(215¢)

^a One set of values are drawn with replacement from the uniform distribution on [0, \$9.99]. A random constant was added to all values in each period 1-12, and the individual assignments randomized.

^b Each period was 4 min duration.

^c Periods 1-12 were 4 min duration, period 13 was 6 min duration to allow more time for mug trading.

^d Volume for number of mugs traded in period 13. Price in cents is shown in parenthesis. The price tag, showing \$9.95 was left on each mug, and this was pointed out to the subjects.

Table 8
Comparison of UPDA bids, offers and exchange prices with choice valuations

		Bids	Offers	Prices
Group 1 WTAs	<i>t</i> statistic prob. level	—	-8.68 (0.00)	-4.14 (0.00)
Group 2 WTPs	<i>t</i> statistic prob. level	-9.043 (0.00)	—	0.14 (0.00)

trade, if a trade is truly desired, the resulting distributions of bids and offers provide market incentive-based measures of WTA and WTP that are distinct from the BDM measures elicited in Groups 1 and 2 in Section 1. It is therefore of interest to compare the distribution of the Group I WTA prices with the distribution of closing exchange offers, and the Group II WTP prices with closing exchange bids. We report these *t*-test comparisons in Table 8. In these comparisons we use only the bid/offer data for the exchange experiments in which the mug prices were unknown, since this was the treatment condition in the choice data for Groups 1 and 2. Both the offer and the bid distributions are significantly below the corresponding Group 1 WTA and Group 2 WTP distributions. The choice procedure does not yield valuations that are good predictors of the actual bids and offers submitted in the iterative market setting.

Also in Table 8 we report comparisons of the Group 1 and 2 valuations with the sample of all mug prices from the exchange experiments. These comparisons show that prices are significantly below the Group 1 WTAs, but not the Group 2 WTPs. Thus the WTPs based on choice data are a better indicator of the level of exchange prices than are the WTAs. Coursey et al. (1987) report similar findings in their study of the disparity between WTA and WTP.

In a new study using repeated second price auctions to measure WTP and WTA for goods with close substitutes (candy bars and mugs), Shogren et al. (1994) find no significant difference between the *average* of WTA and WTP (or price) for these goods. These carefully conducted new experiments cast doubt upon the WTA/WTP discrepancy for goods with close substitutes, and they reject the KKT hypothesis of an endowment effect. Thus, for mugs Shogren et al. (1994, p.265) report WTA/WTP ratios of only 1.08 and 1.05 in two treatments on the final three trials 8–10.

We have no disagreement with their results or conclusions. Their results are not inconsistent with our market results because we directly examine trading volume *not* the WTA/WTP discrepancy. It is very important to realize that mean differences between WTA and WTP in two situations can be indistinguishable statistically, yet trading volume can differ substantially. To see this look at Fig. 1. A slight decrease (increase) in the last four accepted bids (offers) would have no discernible effect on the difference between WTA and WTP, on average, but volume would decrease from 6 to 2 units. Similarly, variation in the WTA/WTP ratio of 1.08 to 1.05 could in our setting (and that of KKT), yield considerable differences in trading volume. The ratio of mean WTA to mean WTP in Table 4 is only 1.05, but the market trades fully, (except for the equal marginal units that add nothing to efficiency).

4. Conclusions and discussion

This paper has reexamined the KKT experimental procedures for identifying an endowment effect for consumer goods; it is based on a series of individual choice experiments, and an independent series of market exchange experiments.

In our choice experiments we removed all reference to buying, selling and prices and reformulated the task uniformly across KKT's three treatment groups as a choice problem. Since each experiment in the choice series was an addendum to a prior unrelated market experiment in which the subjects earned substantial, but highly variable amounts of money, we were able to obtain a measure of any effect on choices due to differential incomes earned or to the buyer/seller role in the previous experiment. We found no income ('house money') or role effects.

Comparing the KKT results with those of our pure choice experiments we find that the KKT use of different instructional descriptions – buyers, sellers, choosers – seems to exaggerate seller's WTA, but their hypothesis of an endowment (possession) effect is supported by our choice data. Consequently, although we observe smaller WTA/WTP discrepancies, their qualitative choice results are robust under the replication procedures used in this paper.

The results of our mug exchange experiments parallel those of the choice experiments although the methodology is quite different. The training experiments using induced valuation generated a wide disparity in the earnings of both buyers and sellers. Since the buyers (sellers) subsequently submit bids (offers) for a mug we could ask whether the reported WTP (WTA) was affected by prior income earnings: for neither the buyers nor sellers was there a significant income or 'house money' effect. The theory predicts that, in the absence of an income effect, half of the 12 seller's mugs should trade. We observed this in two of the ten experiments. In seven experiments 2–4 mugs were traded, in one 5 mugs were traded, and in one 7 were traded. This discrepancy is larger (relative to prediction) than observed in the token (induced value) exchange experiments, but not nearly as large as reported by KKT. Our exchange procedures narrow the discrepancy reported by KKT, but do not eliminate it. We concur with KKT that there does, indeed, appear to be *undertrading* due to an endowment effect.

A comparison of the bid (offer) distribution in the mug exchange experiments with the WTP (WTA) distribution in the choice experiments shows that both the bid and the offer distributions in exchange are below those in the choice experiments: buyers bid less and sellers offer less in actual exchange than is revealed by the procedure. A similar comparison with the exchange mug prices reveals that the WTP distribution in the choice experiment is a better indicator of market value than the WTA distribution.

We accept the Shogren et al. (1994) finding of no *statistically* significant difference between WTA and WTP (for mugs, candy bars) using second price auction measures. They show that the difference does indeed become trivial *relative* to sampling variability over time. But we observe undertrading relative to predictions, which is entirely consistent with persistent small statistical differences between WTA and WTP. Consequently, we are unable to reject the KKT undertrading hypothesis. Statistical insignificance in the WTA–WTP space is associated with economically significant reductions in trade.

As we interpret the evidence, the key hypothesis in KKT that withstands market scrutiny is not the disparity between WTA and WTP, but undertrading.

Is the endowment effect an important characteristic of behavior that should concern us? As an observation contrary to standard preference theory it cannot be lightly dismissed. As a matter of practical importance in markets it is perhaps of little concern. Trade is almost entirely between specialist firms selling to other firms or consumers, not consumers selling to consumers. Garage sales are an exception to the latter where it appears that the propensity to truck barter and exchange is alive and well, even if there is undertrading.

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