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ABSTRACT

Neoclassical theory postulates that preferences between two goods are independent of the consumer's current entitlements. Several experimental studies have recently provided strong evidence that this basic independence assumption, which is used in most theoretical and applied economic models to assess the operation of markets, is rarely appropriate. These results, which clearly contradict closely held economic doctrines, have led some influential commentators to call for an entirely new economic paradigm to displace conventional neoclassical theory—e.g., prospect theory, which invokes psychological effects. This paper pits neoclassical theory against prospect theory by investigating three clean tests of the competing hypotheses. In all three cases, the data, which are drawn from nearly 500 subjects actively participating in a well-functioning marketplace, suggest that prospect theory adequately organizes behavior among inexperienced consumers, whereas consumers with intense market experience behave largely in accordance with neoclassical predictions. The pattern of results indicates that learning primarily occurs on the sell side of the market: agents with intense market experience are more willing to part with their entitlements than lesser-experienced agents.

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Neoclassical models involve several fundamental postulates. While most of the basic tenets appear to be reasonably met, the basic independence assumption—that preferences are independent of the consumer's current entitlements—has been directly refuted in several experimental settings (see, e.g., Daniel Kahneman et al., 1990; Ian Bateman et al., 1997). Although numerous theories have been advanced to explain this anomaly, perhaps the most accepted conjecture invokes psychological effects, and is broadly termed "prospect theory" (Daniel Kahneman and Amos Tversky, 1979).[1]

Even though considerable laboratory evidence in favor of prospect theory has accumulated, some economists believe the anomaly is merely the result of a mistake made by inexperienced consumers and through time these consumers will learn, and their behavior will more closely match predictions from neoclassical models (e.g., Peter Knez et al., 1985; Don Coursey et al., 1987; Brookshire and Coursey, 1987). Yet, this evidence has not been entirely convincing, as critics argue that overall the data do not conclusively support the learning premise (e.g., Jack Knetsch and J.A. Sinden, 1987). In light of arguments in Colin Camerer and Robin Hogarth (1999), who note that useful cognitive capital most likely builds up slowly over months or years rather than in the limited duration of a laboratory experiment, it is understandable that this important debate remains unresolved.

The major goal of this study is to extend the generality of the experimental learning results by examining individual behavior within a well-functioning marketplace. My investigation is unique in that my experimental laboratory is an actual marketplace.

[1] Richard Thaler (1980) first coined the term "endowment effect", which implies that a good's value increases once it becomes part of an individual's endowment. Following the literature, in the remainder of the paper I will refer to the anomaly as the endowment effect. The interested reader should see Elizabeth Hoffman and Matthew Spitzer (1993), who provide a nice explanation of other theories.

This approach provides me with an opportunity to observe behavior of agents that have endogenously chosen certain roles within the market, such as being an intense or casual consumer, while simultaneously making use of certain controls afforded by an experiment. A major advantage of examining behavior in a naturally occurring market is that subjects would be engaging in similar market activities (e.g., buying, selling, and trading commodities) regardless of whether I ran a field experiment or was a passive observer. This added realism highlights the naturalness of this particular setting.

My experimental investigation pits neoclassical theory against prospect theory by investigating three clean tests of the competing hypotheses. In the first test, I vary the endowment point across agents and examine individual trading rates of *everyday* consumable goods. Prospect theory predicts a pattern of trading that depends on the nature of current entitlements, whereas neoclassical theory predicts a pattern of trading independent of entitlements. In the second and third tests, I elicit statements of value in actual market auctions. The auction treatments provide data that permit a comparison of Hicksian equivalent surplus and Hicksian compensating surplus as well as a measure of the shape of compensation demanded (Hicksian equivalent surplus) in the number of relinquished goods. In these treatments, prospect theory predicts that Hicksian equivalent surplus will exceed Hicksian compensating surplus and that compensation demanded is *concave* in the number of relinquished goods. Neoclassical theory predicts equivalence of surplus measures and that compensation demanded is *convex* in the number of relinquished goods.

Besides these three tests, a key consideration of this study revolves around understanding how the actual market learning process evolves. In particular, if

preferences are influenced by market experience, what is the underlying learning process at work? Also, since an appropriate understanding of the benefits and costs of public programs is necessary before efficient policies can be advanced, this study explores whether the market findings spill over to the realm of collective choice mechanisms.

The empirical results are sharp and provide three major insights. First, individual trading rates for inexperienced consumers are consonant with predictions from prospect theory. The endowment effect anomaly is not universal, however: consumers that have significant market experience do not exhibit behavior consistent with prospect theory; rather, their behavior is in line with neoclassical predictions. Empirical findings are similar over collective choice mechanisms. Second, these results extend quite well to auction data: whereas Hicksian equivalent surplus is considerably larger than Hicksian compensating surplus for inexperienced agents, the difference converges to zero for experienced agents. The observed convergence is entirely due to lower Hicksian equivalent surplus values among experienced agents. Third, consistent with the pattern of results in the first two tests, compensation demanded is convex (concave) in the number of items being relinquished for experienced (inexperienced) agents.

Overall, the data pattern observed suggests that the learning process at work is one where the psychological effects at the heart of prospect theory are gradually attenuated: experienced agents are more willing to part with their endowments than lesser-experienced agents. In this sense, the data are consistent with the notion that via previous market interaction and arbitrage opportunities, agents have learned to treat goods leaving their endowment as an opportunity cost rather than a loss. This result is congruent with George Loewenstein and Kahneman (1991), who report that the main

effect of endowment is not to enhance the appeal of the good one owns but rather the *pain* of giving it up. Thus, while psychological effects have been extremely popular in explaining the endowment effect anomaly, they may also have some explanatory power regarding the attenuation of the anomaly.

The remainder of this study proceeds as follows. The next section provides a brief background and discusses the experimental design. Sections II and III present the results and conclusions.

I. Background and Experimental Design

Ever since the initial experimental findings that suggested mere ownership of a good may induce an endowment effect, neoclassical models have been under heavy scrutiny, as their basic independence assumption is clearly violated in such scenarios. The treatments herein extend the work of Knetsch (1989) and Bateman et al. (1997), among others. In an influential study, Knetsch (1989) examined trading rates among Cornell undergraduate students and found that 89 percent of those originally endowed with a mug chose to keep the mug, and 90 percent of those endowed with a chocolate bar decided to keep the chocolate bar. Since subjects were allocated to one of the two treatments randomly, a finding of less than 50 percent of the subjects swapping their good provides evidence in favor of prospect theory.

Bateman et al. (1997) use a unique experimental design to provide a further test of prospect theory. Making use of divergences in predictions between neoclassical theory and prospect theory, they use a classroom experiment to test the theories side-by-side. Their experiment was carefully designed to satisfy important criteria necessary for a clean comparison—e.g., incentive-compatible elicitation mechanism, explicit control for

Hicksian income and substitution effects, etc. Like Knetsch (1989), Bateman et al. (1997) find evidence in favor of prospect theory.

A related line of research suggests this anomaly is attenuated when agents obtain significant market experience (Knez et al., 1985; Coursey et al., 1987; Brookshire and Coursey, 1987; List, 2003). The current study is most closely related to List (2003), who controlled for Hicksian income and substitution effects by examining trading rates of *unusual* pieces of memorabilia in the field. List's (2003) field observations indicate an inefficiently low number of trades for naïve traders, consistent with prospect theory. But his data show that market experience and the decision to trade in his experiment are positively correlated.

Given that List (2003) was not primarily interested in testing the major theories, his results are open to interpretation. First, his data may not properly delineate between prospect theory and neoclassical theory because experienced agents may have planned on re-selling the good. The importance of this deficiency is highlighted in Kahneman et al. (1990, p. 1328), who note "there are some cases in which no endowment effect would be expected, such as when goods are purchased for resale rather than for utilization." Thus, the data pattern observed may be driven by spurious correlation, as practiced consumers may have planned on re-selling the good after the experiment.[2] In this sense, the constructed market bore resemblance to a market where pure arbitrage was approached.

Second, the extant literature typically reports endowment effects for *everyday* consumable goods, such as mugs and candy bars. Accordingly, there is little doubt whether subjects have well-structured preferences for the goods used in these

[2] Although in an exit interview List's (2003) subjects stated that they planned to keep the good for personal consumption, critics could contend that this was a case of experimenter satisficing.

experiments. Since List (2003) used several *unique* pieces of memorabilia, which most of the subjects had never previously seen, or heard of, his findings may indicate that experienced subjects are more certain of their preferences (or the goods' values) and therefore trade more often than lesser-experienced agents.[3] Or the results might be suggesting that certain classes of sportscard show consumers derive utility merely from trading (perhaps this is the reason they participate in the sportscard market in the first place). With an eye toward testing the competing hypotheses, and more fully exploring learning effects, I turn to the experimental designs.

Experimental Design IA

As a first attempt to resolve these and other issues, I examine trading rates of everyday consumable goods (mugs and candy bars) in an actual marketplace where subjects typically engage in buying, selling, and trading of sportscards and memorabilia. This exercise represents a particularly strict test of the role of market experience on shaping preferences since psychological research suggests that transfer of learning across situations is quite weak (Loewenstein, 1999).

Figure 1 illustrates the experimental design. Points A, B, C, and D are the initial endowment levels. Point A = (0,1), B = (1,1), C = (0,0), and D = (1,0), where (University of Arizona coffee mug, chocolate candy bar) represent the endowed goods. For example, subjects in treatment group B are endowed with 1 mug and 1 chocolate bar. The University of Arizona coffee mug was an attractive red and white mug that retailed for

[3] Lesser-experienced agents may keep their endowed good simply to avoid making embarrassing mistakes. Thus, if one takes into account informational asymmetries, neoclassical theory and prospect theory have identical predictions for inexperienced agents.

$5.95 at the University of Arizona bookstore. The candy bar was an extra large fine Swiss chocolate bar that retailed for about $6.00 at most fine-retail outlets.

The fundamental insights gained from the treatments come from the choices subjects make to trade their endowment for another point in Figure 1. In Treatment B (C), subjects are endowed with B (C), and **must** trade their position 1,1 (0,0) for either A or D (e.g., they choose A or D and give up B (C)). The decision is therefore which of the two points, A or D, to choose. Likewise, in Treatment A (D), subjects who are initially endowed with a candy bar (mug) decide whether to trade for a mug (candy bar). Hence, the subject can either keep her initial endowment or trade it for the other good.

The four treatments were run on the floor of a sportscard show in Tucson, Arizona.[4] Each participant's experience followed three steps: (1) completing a survey, (2) considering the potential trade, and (3) concluding the transaction and exit interview. In Step 1, the monitor approached individuals entering the marketplace and inquired about their interest in filling out a survey that would take about five minutes.[5] If the individual agreed, the monitor explained that in return for completing the survey the

[4] Many readers may be unfamiliar with sportscard shows. With the rise in popularity of collector sportscards and memorabilia across the U.S. in the past two decades, markets have naturally arisen that organize buyers and sellers. Temporal assignment of the physical marketplace is typically done by a professional association or local sportscard dealer who rents a large space, such as a gymnasium or hotel conference center, and allocates six-foot tables to dealers for a nominal fee. When the market opens, consumers mill around the marketplace, higgling and bargaining with dealers, who have their merchandise prominently displayed on their six-foot table. The duration of a typical sportscard show is a weekend, and a lucrative show may provide any given dealer hundreds of exchange opportunities (buying, selling, and trading of goods). I should note that collector markets, such as the sportscard market, are much more than fringe activities in the U.S.: the *Beckett Fact Sheet* notes that their collector sportscard magazines have a paid circulation of over 889,000 copies. This circulation rate is comparable to popular magazines such as *Gourmet*, *Jane*, and the *New Yorker* (see: http://www.beckett.com/publications/ and http://asme.magazine.org (American society of magazine). Considering collectors broadly, according to the U.S. Mint 2000 Annual Report, "an estimated 125,000,000 American adults collect Q50 Quarters from pocket change with one-third collecting more than 25 of each state from pocket change, and the popularity of the program only increases with time." See http://www.mint/gov). Relatedly, according to a March 13, 2000 article, the universe of stamp collectors includes 6,830,000 people (see: http://www.linns.com/print/archives/20000313/editor.asp).

[5] The survey is contained in Appendix A and is similar to List (2001).

subject would receive her endowed good(s). After physically giving the subject the appropriate endowment (when applicable), the subject proceeded to fill out the survey. No time limit was imposed. In Step 2, the monitor informed subjects in Treatments B and C that they **must** trade their endowment for either point A or D, as represented in Figure 1. In treatment A (D), the monitor informed the subject that she *had the opportunity* to trade her candy bar (mug) for the mug (candy bar). The monitor allowed the subject to inspect both goods. Step 3 closed the experiment and included an exit interview.

I conducted some of the treatments with professional dealers and others with ordinary consumers. The design was used to capture the distinction between consumers that have intense trading experience (dealers) and those that have less trading experience (nondealers). In the nondealer treatments, the endowment point was changed at the top of each hour, so subjects' treatment type was determined based on the time they visited the table at the card show. The dealer treatments took place in the same fashion as the nondealer treatments, with one exception: instead of waiting for participants to arrive at the table, the monitor visited each dealer at her booth before the market opened, alternating the endowment point. The nondealer treatments took approximately fourteen hours to complete (11am to 6pm on Saturday and Sunday), while the dealer treatments took about four hours (7am to 11am on Saturday).

A few aspects of the experimental design merit further consideration. First, note that subjects received the good(s) as payment for completing the survey, and had the good(s) in their possession while filling out the survey. These two attributes have been found to strengthen significantly the predictive accuracy of prospect theory. Second,

when performing this type of trading exercise, care should be taken to select goods of approximately equal value to avoid a result of everyone selecting one type of good. In a market pre-test at a June 2001 Tucson trading card show, I asked fifty dealer and nondealer subjects to choose one of the two items. Twenty-six chose the coffee mug, whereas twenty-four chose the chocolate bar. I therefore concluded that the goods were similar enough in value to use for a trading exercise. Third, no subjects participated in more than one treatment. Fourth, the monitor worked one-on-one with each subject.

Experimental Design IB

Besides these four treatments examining strictly private allocations, because the existence of non-neoclassical preferences has vast importance for the provisioning of public goods, I also ran four treatments using a collective choice mechanism. The four collective choice treatments (denoted AP, BP, CP, DP) use the identical consumable goods that were used in the private allocation treatments. For example, in Treatment AP, subjects are endowed with a candy bar and must vote on a proposition to fund "Mr. Twister", a small metal box placed at the front of the room. If the group chooses to fund Mr. Twister, which is determined via simple majority rule, *all* N (number of subjects in the room) subjects must give their candy bar to the monitor; upon payment, Mr. Twister's handle is cranked N times and N mugs are delivered. Treatments BP, CP, and DP are the public good analogs of Treatments B, C, and D.

Because it was necessary to have group decisionmaking, I used an adjacent room in the same building instead of running these treatments on the floor of the sportscard trading show. In these treatments, each participant's experience typically followed two steps: (1) consideration of the invitation to participate in an experiment that would take

about 30 minutes, and (2) participation in the experiment. In Step 1, the monitor approached potential subjects entering the trading card show and inquired about their interest in participating in an experiment that would take about 30 minutes. If the individual agreed to participate, the monitor briefly explained that in return the subject would earn the chance to receive consumable goods at the experiment. The monitor explained that at a pre-specified time (11:30am, 1:30pm, 2:30pm, and 3:30pm Sunday) the subject should enter an adjacent room to take part in the experiment. Directions to the room were provided and the subject was informed that she would receive instructions for the experiment when she arrived.

Step 2 began when subjects entered the room and signed a consent form in which they agreed to abide by the rules of the experiment. After subjects were situated in the room, the experiment began. The instructions, which are contained in Appendix B, were read aloud, and after everyone understood the mechanism, a vote to fund Mr. Twister was taken. Each subject filled out her own decision sheet (a sample decision sheet is provided in Appendix C). Similar to the private good treatments, no subjects participated in more than one treatment, and I randomized subjects into treatments to ensure an equal representation across referenda. Finally, I used only nondealers in these treatments because dealers could not leave their tables to participate.

Theoretical Predictions

Under individual or group choice, neoclassical theory and prospect theory have sharp and disparate predictions about behavior across the various endowment points. Consider the Hicksian indifference curve in Figure 1. For preferences to be consistent under neoclassical theory, the proportion of subjects who trade the mug for the chocolate

bar should be equal to one minus the proportion who trade the chocolate bar for the mug. Thus, if 70 percent of the subjects endowed with a chocolate bar keep the chocolate bar, for preferences to be Hicksian, approximately 70 percent of subjects endowed with a mug should trade for a chocolate bar. Similarly, for points B and C there should be independence between the point of endowment and the final entitlement.

Alternatively, prospect theory conjectures that a value function exists that is (i) measured over deviations from a reference point, (ii) convex for losses and concave for gains, and (iii) initially steeper for losses than gains (Tversky and Kahneman, 1991). Hence, prospect theory conjectures that mere ownership of a commodity will induce a kink at the point of endowment, making the proportion of subjects who opt to trade the mug for the candy bar considerably less than one minus the proportion who trade the candy bar for the mug. Likewise, prospect theory predicts that subjects endowed at points B and C will opt for point D more often than subjects initially endowed at point A. This same prediction holds when one compares reference points D and B (or D and C)—if prospect theory is an accurate predictor of behavior, then a larger proportion of subjects starting at points B and C will choose A.

In summary, neoclassical theory predicts that if the goods are equally valued, roughly 50 percent of subjects will exit the experiment with a coffee mug and 50 percent of the subjects will exit with a chocolate bar, regardless of their random treatment assignment. Alternatively, prospect theory conjectures that losses loom larger than comparable gains; hence changing the reference point matters. Under prospect theory, the likelihood of leaving with a mug is ordered as follows: those endowed at point D are

most likely to leave with a mug, followed by subjects randomly allocated to points B and C; finally, subjects endowed at point A will be least likely to exit with a mug.

Experimental Design II

In an effort to provide a further test of individual preferences, I examine explicit statements of willingness to accept (WTA) and willingness to pay (WTP) in an incentive-compatible elicitation mechanism: a Vickrey sealed bid second-price auction.[6] Figure 2, which assumes quasi-concave utility functions, illustrates the experimental design. In Figure 2, G represents extra large fine Swiss chocolate bars and $ denotes dollars (note that while numerical subscripts on g represent number of candy bars, subscripts on $ are for notational convenience only and do not depict actual dollar figures). To gather statements of value, I randomly endow subjects at (g_0,$\$_3$) or ($g_3$,$\$_0$). Subjects endowed at ($g_0$,$\$_3$) state three Hicksian compensating surplus (WTP) values: their maximum WTP for g_1-g_0, g_2-g_0, and g_3-g_0 units of G (denoted WTP_1, WTP_2, and WTP_3). Likewise, subjects endowed at (g_3,$\$_0$) state three Hicksian equivalent surplus (WTA) values: their minimum WTA to sell one, two, or three of their candy bars (e.g., to relinquish g_3-g_2, g_3-g_1, and g_3-g_0 of their candy bars, denoted WTA_1, WTA_2, and WTA_3).[7] Each of the subjects knew that only one of the three auctions, to be determined randomly, would be carried out for real.

[6] The import of this robustness test is highlighted by one important lesson from the experimental literature: market institutions matter (see, e.g., Vernon L. Smith, 1982).

[7] A simple exercise of randomly allocating subjects at (g_3,$\$_0$) and ($g_0$,$\$_0$) and eliciting minimum WTA and maximum WTP values does not yield tremendous insights since both prospect theory and neoclassical theory predict a value disparity. Neoclassical theory predicts divergence due to income (shifts in the indifference curve) and substitution (curvature of the indifference curves) effects. This can be seen in Figure 2 by noting $WTA_3=\$_3-\$_0 > WTP_3=\$_0-\$_4$. Prospect theory invokes psychological effects to predict divergences. Thus, it is important to control for Hicksian income and substitution effects by *compensating* WTP subjects to ensure that subjects are moving along the same indifference curve. The amount of compensation used in the WTP treatment is the average WTA_3.

The treatments were run on the floor of a sportscard show in Tucson, Arizona. Each participant's experience followed four steps: (1) completing a survey, (2) learning the auction rules, 3) considering the bid (offer), and (4) concluding the transaction and exit interview. In Step 1, the monitor approached individuals entering the trading card show and inquired about their interest in filling out a survey.[8] If the individual agreed, then the monitor explained that in return for completing the survey the subject would receive an endowment (either three candy bars or the dollar value equivalent of the three candy bars—see footnote 7). After the monitor physically gave the subject the appropriate endowment, the subject proceeded to fill out the survey. The monitor worked one-on-one with the participant and no time limit was imposed. In Step 2, the monitor informed the subject that she now had the opportunity to bid (offer) in an auction for the goods on the table (their goods). After inspecting the goods, the subject learned the rules of the Vickrey second-price auction as well as the randomization mechanism (Appendix D contains the experimental instructions).

In the WTP (WTA) treatment, after completing the survey, learning the auction rules, and examining the goods, each participant privately wrote three bids (offers) on the bidding sheet and placed it in an opaque box. The monitor informed the participant that her bidding sheet would not be opened until after the show and that all bids/offers would be destroyed when the research project was completed. Each subject worked one-on-one with the monitor and no time limit was imposed on her inspection of the goods. In Step 4, the monitor explained that if the participant won the auction, she would be contacted by email or telephone within three days. Upon receipt of payment, the monitor would send her the candy bars (or money), postage paid.

[8] The survey is identical to Appendix A.

Before proceeding, I should mention a few important aspects of the experimental design. First, subjects were randomly placed into either the WTA or WTP treatment, and competed against others in the same treatment. Second, no subject participated in more than one treatment. Third, since I am not testing the incentive-compatibility of the mechanism, and want to avoid any excess noise, I informed subjects that it was in their best interest to bid (offer) their true value in the auctions. I reinforced this notion via several examples that illustrated the optimal strategy of truth-telling. Fourth, I included only nondealers in the treatments since dealer availability was limited at this particular show. Fifth, each subject in the WTP treatment received the dollar value equivalent (average WTA_3 = \$14.78) of the three candy bars received by the WTA subjects.

Theoretical Predictions

Across these auction treatments neoclassical theory and prospect theory have sharp and quite disparate predictions. A first difference in predictions is that neoclassical theory conjectures $WTA_3 = WTP_3$, whereas prospect theory predicts $WTA_3 > WTP_3$. This first test therefore represents a fundamental examination of whether individuals' indifference curves are perfectly reversible—the basic independence assumption. This test is similar to the trading exercise in Experimental Design IA. Any other comparisons of WTA and WTP are not enlightening since both theories predict a disparity—offers and bids represent movements along *different* segments of the same indifference curve.[9]

While further comparison of WTA and WTP values may not yield considerable insights, indifference curve convexity implies convexity of the expenditure function in

[9] This is true unless there is infinite substitutability between money and candy bars, in which case neoclassical theory predicts no value disparity, whereas prospect theory predicts divergences.

g.[10] Because the expenditure function is strictly convex in g, compensation demanded will also be strictly convex in g. In this case, neoclassical theory yields several predictions about the nature of compensation demanded in the number of goods relinquished: $2WTA_1<WTA_2$, $3WTA_1<WTA_3$, $3WTA_2<2WTA_3$, and $WTA_1+WTA_3<2WTA_2$.

Alternatively, as previously mentioned, a major conjecture in prospect theory is diminishing sensitivity, or that small gains are disproportionately more attractive relative to large gains, and small losses disproportionately aversive relative to large losses. Intuitively, convexity of the value function in losses is motivated by the idea that the decline in value from a loss of \$1100 to a loss of \$1200 is less than the decline in value from a loss of \$100 to a loss of \$200. Convexity of the loss value function implies *concavity* of compensation demanded. Thus, again prospect theory has predictions that are directly at odds with neoclassical theory: $2WTA_1>WTA_2$, $3WTA_1>WTA_3$, $3WTA_2>2WTA_3$, and $WTA_1+WTA_3>2WTA_2$.[11]

II. Results

Table 1 provides a statistical description of the subject characteristics in each of the ten treatments as well as a summary of the experimental design. In total, I observed behavior of nearly 500 subjects–more than 30 subjects in each dealer and non-dealer

[10] This fact can be proven as follows: if the utility function $u(g,\$)$ is quasi-concave in $(g,\$)$, then the set $S(q,u^*) =\{\$|u(g,\$) \geq u^*\}$ is convex. Because $S(g)$ is convex, the set $\lambda S(g_0) + (1-\lambda)S(g_1) \subset S(\lambda g_0+(1-\lambda)g_1)$ for $0<\lambda<1$. Hence, we have $m(p,g_0,u^*) = \inf\{\$\cdot p|\$\in S(g_0)\}$; $m(p,g_1,u^*) = \inf\{\$\cdot p|\$\in S(g_1)\}$; and $m(p,\lambda g_0 +(1-\lambda)g_1,u^*) = \inf\{\$\cdot p|\$\in S(\lambda g_0 +(1-\lambda)g_1)\}$. Convexity in g requires $\lambda m(p,g_0,u^*) +(1-\lambda)m(p,g_1,u^*) \geq m(p,\lambda g_0 +(1-\lambda)g_1,u^*)$. The first expression can be rewritten $\lambda m(p,g_0,u^*)+(1-\lambda)m(p,g_1,u^*) = \inf\{\$\cdot p|\$\in \lambda S(g_0)+(1-\lambda) S(g_1)\}$. But, $\inf\{\$\cdot p|\$\in \lambda S(g_0) + (1-\lambda)S(g_1)\} \geq \inf\{\$\cdot p|\$\in S(\lambda g_0 +(1-\lambda)g_1)\}$ because $\lambda S(g_0) + (1-\lambda) S(g_1) \subset S(\lambda g_0+(1-\lambda)g_1)$. Therefore, the expenditure function is convex in g (see Maler, 1974).

[11] Examination of the shape of WTP yields no discernible tests since both theories predict that WTP is concave in g. The interested reader should see Brookshire and Coursey (1987) for an early study that gathered numerous statements of compensation demanded.

treatment for the private good trading treatments (Treatments A-D), roughly 30 subjects for each of the public good trading treatments (Treatments AP-DP), and 120 subjects in the auctions (Treatments WTA, WTP).

Central tendencies of the variables reported in columns 1-3 of Table 1 are from the pooled trading treatment data and reveal that dealers are much more active traders (denoted trading intensity), and have had more years of market experience, than nondealers. More importantly, within each of the dealer and nondealer subsamples there is a considerable amount of subject variability in the level of trading intensity and years of market experience, permitting an analysis of the effect of market experience on behavior. In the data analysis below, I focus on the effects of trading intensity on behavior. Yet I should note that if I use a measure of the stock of market experience—the product of trading intensity and years of market experience—empirical results are qualitatively similarly. Thus, I interchange "market intensity" and "market experience" for the remainder of this study.

Table 2, which provides a summary of the trading data for both nondealers and dealers, can be read as follows: row 1, column 1, at the intersection of "Treatment A" and "Number of Subjects Choosing A," denotes that 25 nondealer subjects out of 31 (81 percent) that were initially endowed with 0 mugs and 1 chocolate bar chose to keep the chocolate bar. The figure in row 1, column 2, complements this result and indicates that 6 out of 31 (19 percent) nondealers opted to trade their chocolate bar for the coffee mug. The third column in Table 2 presents Pearson chi-square tests, which examine the null hypothesis of H_o: $p_A = p_B = p_C = p_D$; where p_i are the parameters of 4 independent binomially distributed random variables, and therefore the null hypothesis tests whether

there is a treatment effect. If the null hypothesis cannot be rejected, then evidence is in favor of neoclassical theory; rejection of the null (with the correct p_i signs) provides evidence in favor of prospect theory.

Overall, empirical results in panel A for ordinary consumers provide strong support for prospect theory. As we move downward in column 1 of Table 2 from Treatment A to Treatment D, a considerable number of subjects exhibit behavior in line with prospect theory: whereas 81 percent of nondealers choose point A in Treatment A, this percentage decreases significantly in Treatments B and C, and declines even further in Treatment D—to 23 percent. The trading figures from Treatments A and D both suggest that subjects were about four times more likely to exit the experiment with their endowed good (computed as $\frac{1}{2}(P_{i|i}/P_{i|j}) + (P_{j|j}/P_{j|i})$). A Pearson chi-square test (~3 degrees of freedom) suggests that the null hypothesis of no treatment effect should be rejected at the $p < .01$ level ($\chi^2 = 19.21$).

Examining behavior within the realm of a collective choice mechanism (in panel B of Table 2) reveals nearly identical insights—88 percent and 83 percent of subjects kept their endowed goods in treatments AP and AD, and slightly more than 50 percent of subjects opted for the chocolate bar in Treatments BP and CP. A Pearson chi-square test again suggests that the homogeneity null should be rejected at the $p < .01$ level ($\chi^2 = 34.79$). While there seems to be a slight tendency for subjects to exhibit a greater level of endowment in the collective choice treatments than in the individual choice treatments, the differences are not significant at conventional levels. Accordingly, whether behavior is observed over private or collective allocation, the data for ordinary consumers provide strong support in favor of prospect theory. This evidence, which is consistent with

previous experimental studies, is at odds with conventional economic theory, which assumes that indifference curves are reversible.

Panel C in Table 2 tells a much different story, however. For example, the data are not in accord with prospect theory's reference point prediction. In fact, quite the contrary result emerges—the data clearly emerge in support of neoclassical theory. First, prospect theory predicts that losses are weighted more heavily than gains. Yet, of the 30 subjects initially endowed with a chocolate bar (Treatment A), only 14, or 47 percent, keep the chocolate bar. This trading pattern holds for Treatment D as well: 44 percent (14 of 32) of subjects trade their coffee mug for the chocolate bar. The intermediate points provide a comforting validity check, as roughly 50 percent of subjects in Treatments B and C leave with mugs. As neoclassical theory would predict, according to a Pearson chi-square test the null hypothesis cannot be rejected at conventional significance levels ($\chi^2 = 0.59$).

Table 3 splits the data from Treatments A, D, AP, and DP into distinct "experience" subsamples to more fully explore the influence of market experience on the exchange rate. While the experience thresholds may appear *ad hoc*, I used the mean (≈6) and standard deviation (≈6) of trading intensity as guidance. Liberal changes to these thresholds do not significantly change the nature of the results. The pooled data indicate that 18 percent of nondealers preferred an exchange. Using a Fisher's Exact test, I find that the null hypothesis of no endowment effect in the pooled data should be rejected at the $p < .01$ level ($z = 7.32$). Even though exchange rates considerably increase as market experience increases, Fisher's exact tests suggest that the null hypothesis should be rejected for those consumers that trade fewer than 6 times in a typical month

(inexperienced consumers, row 2: $z = 6.97$) as well as for those consumers that make 6 or more trades in a typical month (experienced consumers, row 3: $z = 3.48$).

When we move to intense consumers—those consumers who trade more than 12 times per month, where 12 is roughly equivalent to the mean plus one standard deviation—a much different result emerges. In these data, 56 percent of subjects preferred an exchange and the null hypothesis cannot be rejected at conventional levels ($p = 0.64$; $z = 0.33$). Data from the dealer sample (contained in row 5 of Table 3) strongly reinforce empirical results from the intense consumer data: 48 percent of dealers preferred an exchange, and according to a Fisher's exact test it is inappropriate to reject the null hypothesis of no endowment effect ($p = 0.80$; $z = 0.23$).

To provide a visual characterization of the pooled trading data (pooled across 129 dealers and 62 nondealers), I present Figure 3, which includes data across the 191 subjects and makes the trade probability a function of trading intensity. The figure clearly shows that individual behavior converges to the neoclassical prediction as trading experience intensifies—subjects who trade 11 or more times in a typical month conform well to neoclassical predictions.

The second and third tests of prospect theory and neoclassical theory revolve around the auction data. Following the analysis above, I begin by presenting Table 4, which provides sample statistics for WTA and WTP measures of value across several experience thresholds. Again, in choosing thresholds for these samples, I considered both the mean number of trades in a typical month (≈5) and its standard deviation (≈5) (see Table 1). A first important insight gained from Table 4 is the discrepancy between Hicksian equivalent surplus and Hicksian compensating surplus for the three candy bars

in the pooled data (row 1). While compensation demanded is \$14.78, WTP is only \$7.73. This value difference of nearly 50 percent is significant at the $p < .01$ level using a large-sample t-test ($t = 6.30$) and suggests that preferences are inconsistent.[12]

Parsing the data into subcategories yields insights that are consonant with the trading results: predictions from prospect theory are met in the inexperienced consumer group, as WTA_3 (\$18.36) is significantly greater than WTP_3 (\$7.54) at the $p < .01$ level ($t = 7.30$). Yet data from the more experienced groups align with neoclassical predictions: neither experienced consumers' values (WTA_3=\$10.10, WTP_3=\$7.89) nor intense consumers' values (WTA_3=\$8.21, WTP_3=\$7.43) are significantly different at the $p < .05$ level (experienced: $t = 1.72$; intense: $t = 0.72$).[13] Interestingly, the convergence of values is entirely due to lower Hicksian equivalent surplus values among experienced agents—inexperienced consumers provide a WTA_3 value of \$18.36, whereas intense consumers provide a WTA_3 value (\$8.21) that is \$10.16 lower, a difference of 55 percent, which is significant at the $p < .01$ level ($t = 6.70$). A comparison of WTP_3 values across these same subject groups provides negligible value differences (\$7.54 versus \$7.43).

The third test of the two theories requires a more careful exploration of the curvature of Hicksian equivalent surplus measures over the number of relinquished goods. Table 5 presents summary statistics across the curvature measures for each of the subsamples. Panel A in Table 5 provides means and standard deviations for the measures: $2WTA_1 - WTA_2$, $3WTA_1 - WTA_3$, $3WTA_2 - 2WTA_3$, and $WTA_1+WTA_3 - 2WTA_2$. Accordingly, a negative entry in panel A indicates a tendency toward concavity of compensation demanded, whereas a positive figure indicates a tendency toward

[12] These results, and those discussed above, are consistent across parametric and non-parametric tests.
[13] Note that WTP is concave in g for all subsamples, as predicted by both theories.

convexity. The data pattern strongly supports results from the first two tests. For inexperienced consumers, three out of the four measures support prospect theory: at the $p < .05$ level the data in columns 1-3 all support *concavity* of the Hicksian equivalent surplus measures. The fourth measure in column 4 is directionally correct but not significant at conventional levels.

Data gathered from the experienced and intense consumer samples provide evidence that supports neoclassical predictions, as *convexity* of compensation demanded is evident. For experienced consumers, the differences are significant at the $p < .05$ level for the first two column measures and at the $p < .08$ and $p < .15$ levels for the last two column measures. For intense consumers the results become sharper, as significance is achieved at the $p < .05$ level for the first three column measures and at the $p < .12$ level for the fourth column measure.

Panel B in Table 5 presents a much more disaggregated look at the WTA data by compiling the number of subjects that comply with neoclassical theory (denoted NT) and prospect theory (denoted PT) for each of the four curvature measures.[14] Besides providing a robustness check of whether a few outliers are driving the results displayed in panel A, these figures provide a sense of individual-level behavior. One can draw inference from these figures by moving up and down rows in any given column, or across columns in any given row.

Overall, the data in panel B provide insights comparable to inference gained from panel A. First, in the pooled data the number of subjects conforming to neoclassical

[14] A zero value for any particular measure indicates linearity and is not counted as following either theory. Hence, the summation of the number of subjects following neoclassical theory and prospect theory for each measure is not equal to the total number of subjects that participated in the treatment.

theory and prospect theory is roughly equivalent across all four curvature measures. Second, across the four curvature measures, 41-65 percent (18-29 percent) of inexperienced agents conform to prospect theory (neoclassical theory). A test of proportions indicates that for curvature measures in columns 1-3, a significantly greater proportion of inexperienced agents conform to prospect theory than neoclassical theory ($z = 2.76$; $z = 3.94$; $z = 2.46$).

Third, 50-70 percent (19-23 percent) of *experienced* agents are in line with neoclassical (prospect theory) predictions. Using a test of proportions, I find that for all four curvature measures these differences are significant at the $p < .05$ level. Fourth, 50-72 percent (16-22 percent) of intense consumers conform to neoclassical predictions (prospect theory predictions). Again, a proportions test indicates that in all four curvature cases these differences are significant at the $p < .05$ level. Finally, comparing the proportion of subjects who conform to neoclassical theory or prospect theory *across* the inexperienced and experienced consumer samples, I find that for each of the four curvature measures, experienced (inexperienced) consumers are significantly more likely to behave in accordance with neoclassical theory (prospect theory).

Although analysis of the raw data provides evidence that suggests market experience attenuates the anomaly, there has been no attempt to control other factors that may affect the propensity to trade or the bid/offer level. These other subject-specific factors, which include years of market experience, gender, income, education, and age, can be adequately accounted for in an econometric model. In Appendix E, I present a series of empirical results that are consistent with the unconditional results discussed above. For

example, market experience is found to influence trading rates and considerably influences Hicksian equivalent surplus measures, as suggested by the unconditional analysis.

Combining results from the entire set of exercises provides the following major insight: while prospect theory can go a long way in explaining behavior of naïve subjects, behavior converges to the neoclassical prediction as subjects gain market experience. Figure 4 provides a summary of individual behavior across the WTA and WTP treatments. The figure includes data across the 120 subjects and makes the WTA/WTP ratio a function of trading intensity. Akin to Figure 3, Figure 4 clearly shows that individual behavior converges to the neoclassical prediction as trading experience intensifies. In light of the extant body of psychological evidence that reports limited transfer of learning across tasks, these results are quite surprising.

The richness of the data also permits an examination of the underlying market learning process. In this sense, the results in this study rule out many potential explanations that could not be discarded in previous data sets (e.g., List, 2003). For example, preference uncertainty, subjects obtaining utility from the trading exercise, avoidance of dealing with informed agents when one is ill-informed, etc., cannot credibly explain all of the trading and auction results herein.[15] Yet the data are broadly consistent with at least one potential explanation: as aforementioned, recent findings suggest that the main effect of endowment is not to enhance the appeal of the good one owns, but rather the pain of giving it up (Loewenstein and Kahneman, 1991). Thus, via market interaction and numerous arbitrage opportunities, practiced agents may have learned to overcome this "pain" and treat the good leaving their endowment as an opportunity cost

[15] While these data do not discern between treatment effects (learning) versus selection effects (subject pool), List (2003) presents evidence that suggests learning drives the observed behavioral differences.

rather than a loss. While psychological effects have been extremely popular in explaining the endowment effect anomaly, data herein suggest that psychological effects may also help to explain the attenuation of the anomaly.

III. Concluding Remarks

Indifference curves are traditionally drawn without reference to current entitlements. In practice, this convention implies that with small income effects and many available substitutes differences between equivalent and compensating variation are negligible. From a positive perspective, this assumption represents a necessary condition for the invariance result of Coase. In a normative sense, this interpretation of indifference curves legitimizes cost/benefit analysis and provides a basis to resolve damage disputes. Yet substantial evidence has mounted that illustrates the importance of entitlements: in an influential experimental study, Kahneman et al. (1990) provide compelling evidence to reject the basic independence assumption. These experimental findings have been robust across unfamiliar goods, such as irradiated sandwiches, and common goods, such as chocolate bars, persuading even the most ardent supporters of neoclassical theory to doubt the validity of certain neoclassical postulates.

In this study, I make use of three clean tests that pit neoclassical theory against prospect theory. I test the three hypotheses with data gathered from a naturally occurring market. Examining trading patterns and bid/offer schedules in actual auctions for *everyday* consumables yields several unique insights. First, prospect theory is found to have strong predictive power for inexperienced consumers across both the trading and auction treatments. Second, for those consumers that have had a considerable amount of exchange opportunity in the sportscard marketplace, neoclassical theory predicts

reasonably well, as I find sharp evidence that behavior approaches the neoclassical prediction for experienced agents. In light of the extant body of psychological evidence that reports limited transfer of learning across tasks, these results are quite surprising. The tentative conclusion regarding the underlying learning process at work is that agents with intense market experience have learned to part with entitlements, suggesting attenuation of the anomaly appears to take place on the sell side of the market rather than on the buy side.

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Table 1 Selected Characteristics of Participants

	Trading Treatments			Auction Treatments	
	Dealers	**Nondealers**	**Nondealers**	**Nondealers**	
	Mean (Std. dev.)	Mean (Std. dev.)	Mean (Std. dev.)	Mean (Std. dev.)	
				WTA	**WTP**
Trading intensity	11.81 (10.9)	4.94 (6.58)	6.88 (6.39)	5.07 (5.24)	5.23 (4.82)
Yrs. of market experience	9.88 (9.79)	7.15 (9.83)	7.21 (8.03)	10.13 (10.71)	8.92 (9.90)
Income	4.15 (1.75)	4.10 (1.69)	4.18 (1.81)	3.55 (2.27)	3.78 (2.24)
Age	36.55 (13.1)	34.54 (14.41)	37.04 (14.1)	31.74 (13.42)	31.61 (14.38)
Gender (% male)	0.94 (0.24)	0.85 (0.35)	0.82 (0.39)	0.83 (0.38)	0.83 (0.38)
Education	3.54 (1.40)	3.44 (1.33)	3.54 (1.54)	3.51 (1.70)	3.48 (1.68)
Sample Sizes					
Treatment A	30	31	---	---	---
Treatment B	32	30	---	---	---
Treatment C	35	33	---	---	---
Treatment D	32	30	---	---	---
Treatment AP	---	---	33	---	---
Treatment BP	---	---	28	---	---
Treatment CP	---	---	29	---	---
Treatment DP	---	---	35	---	---
WTA/WTP	---	---	---	60	60

Notes:

1. *Trading intensity* represents the number of trades made in a typical month.
2. *Yrs. of market experience* denotes years that the subject has been active in the market.
3. *Income* denotes categorical variable (1-8): 1) Less than $10,000, 2) $10,000 to $19,999, 3) $20,000 to $29,999, 4) $30,000 to $39,999, 5) $40,000 to $49,999, 6) $50,000 to $74,999, 7) $75,000 to $99,999 8) $100,000 or over.
4. *Age* denotes actual age in years.
5. *Gender* denotes categorical variable: 0 if female, 1 if male.
6. *Education* denotes categorical variable 1) Eighth grade or less, 2) High School 3) 2-Year College, 4) Other Post-High School, 5) 4-Year College, 6) Graduate School Education.

Table 2 Experimental Results for Trading Treatments

	Number of Subjects Choosing A	Number of Subjects Choosing D	Pearson χ^2
Panel A. Nondealers			
Treatment A	25 (81%)	6 (19%)	19.21 (3 df)
Treatment B	18 (60%)	12 (40%)	
Treatment C	15 (45%)	18 (55%)	
Treatment D	7 (23%)	23 (77%)	
Panel B. Nondealers			
Treatment AP	29 (88%)	4 (12%)	34.79 (3 df)
Treatment BP	16 (57%)	12 (43%)	
Treatment CP	17 (59%)	12 (41%)	
Treatment DP	6 (17%)	29 (83%)	
Panel C. Dealers			
Treatment A	14 (47%)	16 (53%)	0.54 (3 df)
Treatment B	14 (44%)	18 (56%)	
Treatment C	18 (51%)	17 (49%)	
Treatment D	14 (44%)	18 (56%)	

Notes:

1. Initial endowment levels are as follows: Treatment A = (0,1); Treatment B = (1,1); Treatment C = (0,0); Treatment D = (1,0), where (University of Arizona coffee mug, chocolate bar) are the private goods. Treatments AP, BP, CP, and DP are public good analogs of Treatments A-D.
2. Pearson Chi-Square test, which is distributed with 3 degrees of freedom, has a null hypothesis of Hicksian preferences, or that the proportions of subjects choosing A and D are equivalent across treatments.

Table 3 Summary Trading Statistics

Group	Preferred Exchange	p-value for Fisher's exact test
Pooled nondealers (n = 129)	0.18 (0.38)	<0.01
Inexperienced consumers (< 6 trades monthly; n = 74)	0.08 (0.27)	<0.01
Experienced consumers (≥ 6 trades monthly; n = 55)	0.31 (0.47)	<0.01
Intense consumers (≥ 12 trades monthly; n = 16)	0.56 (0.51)	0.64
Pooled dealers (n = 62)	0.48 (0.50)	0.80

Notes:

1. Data are from Treatments A, D, AP, and DP. Standard deviations are in parentheses.
2. Experienced consumers are those consumers who trade 6 or more times per month (6 is roughly the mean level of monthly trades). Intense consumers trade 12 or more times per month (12 is roughly the mean plus one standard deviation).
3. Fisher's exact test has a null hypothesis of no endowment effect.

Table 4 WTA/WTP Sample Statistics Across Consumer Types

Group	WTA_1 Mean (Std. dev.)	WTA_2 Mean (Std. dev.)	WTA_3 Mean (Std. dev.)	WTP_1 Mean (Std. dev.)	WTP_2 Mean (Std. dev.)	WTP_3 Mean (Std. dev.)
Pooled						
Bid or Offer (WTA, n=60) (WTP, n=60)	5.58 (3.7)	10.04 (5.4)	14.78 (7.0)	4.11 (2.5)	5.99 (3.6)	7.73 (5.0)
Inexperienced consumers						
Bid or Offer (WTA, n=34) (WTP, n=27)	7.75 (3.5)	13.16 (4.6)	18.36 (6.1)	4.08 (3.0)	5.91 (3.7)	7.54 (5.2)
Experienced consumers						
Bid or Offer (WTA, n=26) (WTP, n=33)	2.74 (1.31)	5.96 (3.0)	10.10 (5.0)	4.14 (2.0)	6.05 (3.5)	7.89 (4.8)
Intense consumers						
Bid or Offer (WTA, n=18) (WTP, n=15)	2.29 (0.83)	5.00 (1.9)	8.21 (2.5)	3.87 (1.8)	6.28 (3.3)	7.43 (3.7)

Note: "Inexperienced" consumers are those that trade fewer than 5 times in a typical month; "Experienced" consumers are those that trade 5 or more times in a typical month; "Intense" consumers are those that trade 10 or more times per month. In choosing these thresholds, I considered both the mean number of trades in a typical month (≈5) and its standard deviation (≈5) (see Table 1). Thus, "Inexperienced" consumers are those subjects who are below the average trading rate; "Experienced" consumers are those subjects who are above the average trading rate; and "Intense" consumers are those consumers at least one standard deviation above the average trading rate.

Table 5 WTA Summary Results Across Consumer Types

Group	WTA_2-$2WTA_1$ Mean (Std. dev.)	WTP_3-$3WTA_1$ Mean (Std. dev.)	$2WTA_3$-$3WTA_2$ Mean (Std. dev.)	WTA_1+WTA_3–$2WTA_2$ Mean (Std. dev.)
Panel A: Aggregate data				
Pooled (n=60)	-1.12* (4.0)	-1.96 (8.1)	-0.56 (7.3)	0.28 (3.4)
Inexperienced consumers (n=34)	-2.35* (4.9)	-4.91* (9.2)	-2.76* (7.1)	-0.20 (3.5)
Experienced consumers (n=26)	0.50* (1.2)	1.89* (4.1)	2.32 (6.6)	0.92 (3.2)
Intense consumers (n=18)	0.43* (0.8)	1.34* (1.8)	1.42* (3.2)	0.50 (1.7)

	NT	**PT**	**NT**	**PT**	**NT**	**PT**	**NT**	**PT**
Panel B: Individual data—number of subjects satisfying each theory								
Pooled (n=60)	20	23	24	27	25	25	25	20
Inexperienced consumers (n=34)	7	18	6	22	9	19	10	14
Experienced consumers (n=26)	13	5	18	5	16	6	15	6
Intense consumers (n=18)	9	3	13	3	13	3	11	4

Notes: For definition of consumer types please see Table 4. NT and PT denote neoclassical theory and prospect theory. Figures in Panel B on the number of subjects following each theory is determined by the signs of the four measures: WTA_2-$2WTA_1$, WTP_3-$3WTA_1$, $2WTA_3$-$3WTA_2$, and WTA1+WTA_3–$2WTA_2$. A positive value (implying convexity in the number of goods relinquished) is in favor of neoclassical theory whereas a negative value (implying concavity in the number of goods relinquished) favors prospect theory. A zero value indicates linearity and is not counted as following either theory; hence, the summation of the number of subjects following NT and PT for each convexity measure is not equal to the total number of subjects that participated. In panel A, a * indicates value is significantly different from zero at the $p < .05$ level.

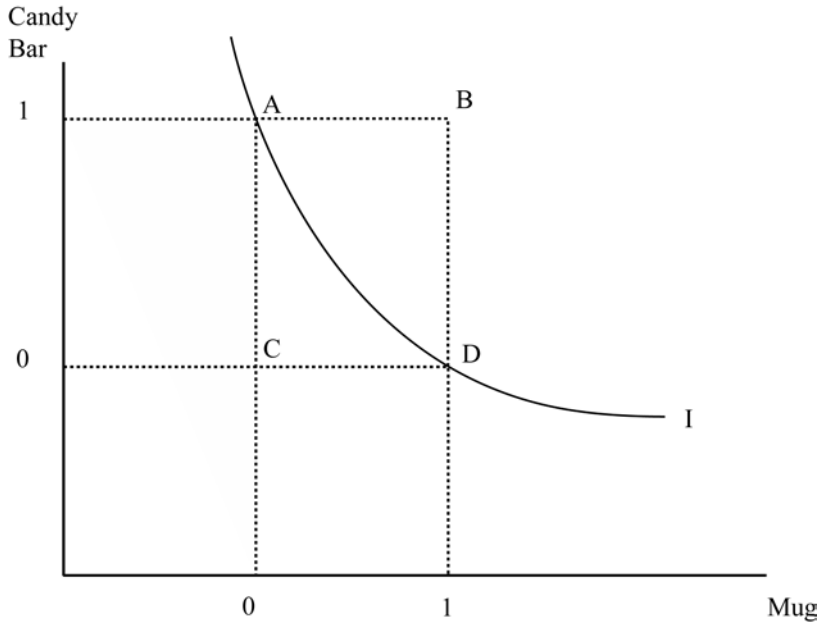


Figure 1. Experimental Design I

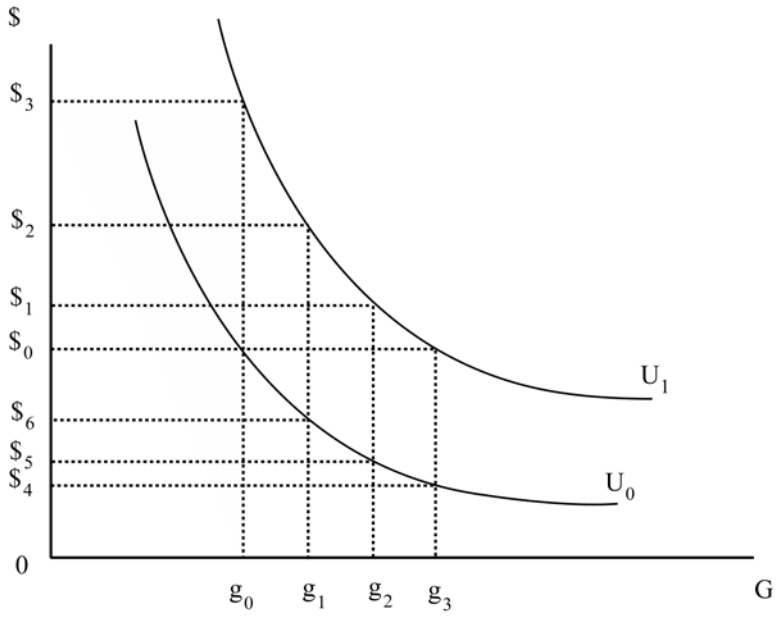


Figure 2. Experimental Design II

Figure 3. Summary of Trading Results

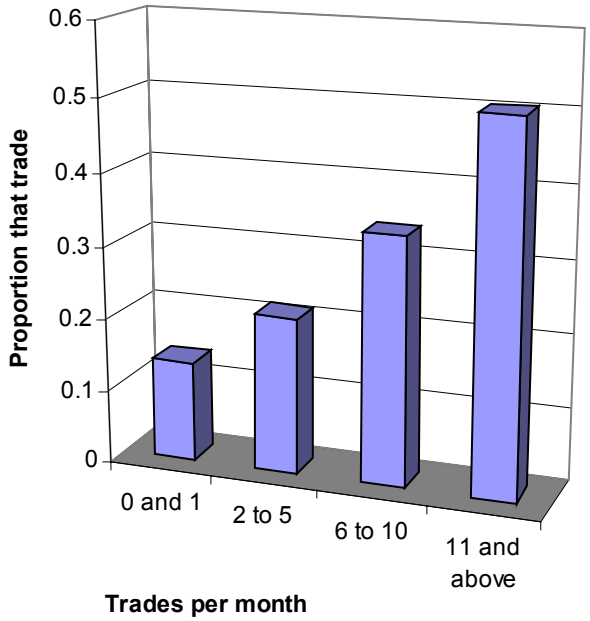
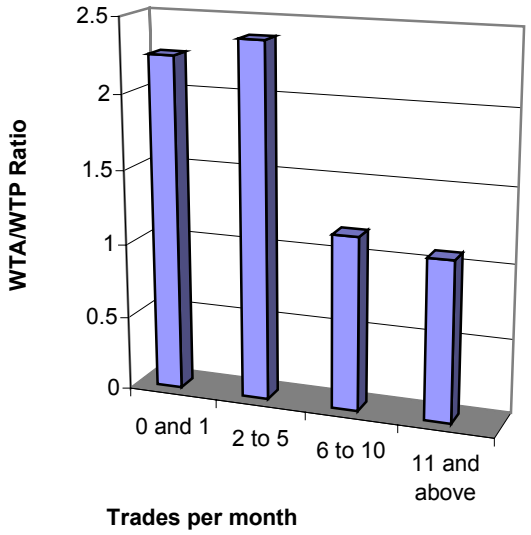


Figure 4. Summary of WTA/WTP Ratios



Appendix A Private Good Trading Treatments Survey

These questions will be used for statistical purposes only. THIS INFORMATION WILL BE KEPT STRICTLY CONFIDENTIAL AND WILL BE DESTROYED UPON COMPLETION OF THE STUDY.

1. How long have you been active in the sportscards and memorabilia market? _____yrs

2. Approximately how many trades (cards or memorabilia) do you make in a typical month? _____. Note that trades could include pokemon cards, sportscards, other trading cards, and sports memorabilia.

Has your trading rate changed over time? Why?

3. Are you a sportscard or sports memorabilia professional dealer?_____

4. Gender: 1) Male 2) Female

5. Age _____ Date of Birth _____

6. What is the highest grade of education that you have completed. (Circle one)
   1) Eighth grade 3) 2-Year College 5) 4-Year College
   2) High School 4) Other Post-High School 6) Graduate School Education

7. What is your approximate yearly income from all sources, before taxes?
   1) Less than $10,000 5) $40,000 to $49,999
   2) $10,000 to $19,999 6) $50,000 to $74,999
   3) $20,000 to $29,999 7) $75,000 to $99,999
   4) $30,000 to $39,999 8) $100,000 or over

Appendix B Summary of the Instructions for Public Goods Treatment AP

Welcome!! For participating in today's experiment, we give you a Swiss fine extra large chocolate bar, which should be in front of you. Today you have the opportunity to vote on whether "Mr. Twister", this small metal box, will be "funded". If "Mr. Twister" is funded, I will turn the handle and N [the amount of people in the room] University of Arizona coffee mugs will be distributed—one to each participant [illustrate]. To fund Mr. Twister, **all** of you will have to give me your chocolate bar. Below please find the proposition and referendum rules.

Proposition

Everyone in the room will contribute their chocolate bar to the fund. The contribution will be used for the purpose of funding Mr. Twister, a mechanism that if funded will distribute one University of Arizona coffee mug to everyone [illustrate].

Referendum Rules

- If more than 50% of you vote **YES** on this proposition, **all** of you will give me your chocolate bar. In return, "Mr. Twister" will be funded and I will crank the handle, providing one University of Arizona coffee mug to each participant [illustrate].

- If 50% or fewer of you vote **YES** on this proposition, **no one** will give me their chocolate bar and "Mr. Twister" will **not be funded**. Hence, no one will receive a University of Arizona coffee mug.

Any questions? You should note that it is in your best interest to truthfully reveal your preferences—if you want to keep the chocolate bar, vote NO on the proposition. If you prefer the mug, vote YES on the proposition.

I now want you to complete the decision sheet.

Appendix C Decision Sheet for the Public Good Treatments

My vote for the proposition is (please circle one response):

YES **NO**

Please sign the line below to verify your vote.

Signature_____

We now want to ask you a few more questions. These questions will be used for statistical purposes only. THIS INFORMATION WILL BE KEPT STRICTLY CONFIDENTIAL AND WILL BE DESTROYED UPON COMPLETION OF THE STUDY.

1. How long have you been active in the sportscards and memorabilia market? _____yrs

2. Approximately how many trades (cards or memorabilia) do you make in a typical month? _____. Note that trades could include Pokemon cards, sportscards, other trading cards, and sports memorabilia.

Has your trading rate changed over time? Why?

3. Are you a sportscard or sports memorabilia professional dealer?_____

4. Gender: 1) Male 2) Female

5. Age _____ Date of Birth _____

6. What is the highest grade of education that you have completed? (Circle one)

   1) Eighth grade 3) 2-Year College 5) 4-Year College

   2) High School 4) Other Post-High School 6) Graduate School Education

7. What is your approximate yearly income from all sources, before taxes?

   1) Less than $10,000 5) $40,000 to $49,999

   2) $10,000 to $19,999 6) $50,000 to $74,999

   3) $20,000 to $29,999 7) $75,000 to $99,999

   4) $30,000 to $39,999 8) $100,000 or over

Appendix D Subject Instructions for WTP Vickrey Second-Price Auction

Welcome to Lister's Auctions. The money that I have just given you is yours to keep—thanks for participating! You now have the opportunity to bid in an auction for the candy bars on the table.

Auction Rules:

A sealed bid second-price auction will be used to determine the winner of the auction. Thus, if your bid of $X is the highest bid and the next highest bid is $X-Z, you win the auction but only pay $X-Z. Under this bidding mechanism it is best for you to bid your true value because overbidding may cause you to pay too much and underbidding decreases your odds of winning the auction.

I will accept bids until Sunday at 5PM. On Monday morning I will order the bids from highest to lowest in order to determine the winner.

For example, if the top four bids are ranked highest to lowest as follows:

$A
$B
$C
$D

The bidder who bid **$A** wins the auction and pays **$B**.

Note that there are three candy bars on the table. I am going to have you place three bids. The first bid will be your bid for 1 of the candy bars—this is called auction 1. Your second bid will be your bid for 2 of the candy bars—this will be auction 2. Your third bid will be your bid for all 3 of the candy bars—this will be auction 3.

But, it is important to note that only one of the three auctions will be for real. To decide which one is for real, on Sunday night at 5PM I will roll the six-sided on the table. If a 1 or 2 is rolled, the first auction will be for real; a roll of 3 or 4 and the second auction will be for real; finally, a roll of 5 or 6 and the third auction will be for real.

Note that in this setting it is optimal for you to bid your true value in each of the three auctions.

Given that the winner of the auction will pay a price equal to the amount of the second-highest bid, please place your bids below:

1 candy bar $_____ **2 candy bars** $_____**3 candy bars** $_____

After the winner pays me cash or check, the good(s) will be awarded to the winner (we pay postage). Please sign the dotted line below to verify your bids. Also, please provide your name, telephone number and mailing address below:

Signature_____Printed Name_____

Address_____ or email_____

Phone#_____

Appendix E Conditional Data Analysis

To provide a robustness test of the unconditional results presented in the text, this Appendix presents empirical results that condition on factors that may influence trading rates and bids/offers. For the trading rate data, I estimate the following logit model using data from Treatments A, D, AP, and DP:

$$trade = g(\alpha + \beta`X), \tag{1E}$$

where *trade* equals 1 if a trade was executed, 0 otherwise; g(•) is the standard logit function; and *X* includes subject-specific variables that may affect the propensity to trade. Variables in *X* are listed in Table 1 and include the number of trades in a typical month, years of market experience, yearly income, age, gender, education, and a series of dichotomous variables indicating the initial endowment point. Estimation of equation (1) therefore provides insights into the factors that influence a subject's propensity to trade.

To provide conditional insights into the auction data, I estimate the following bid/offer model:

$$Y = f(\alpha + \beta`X), \tag{2E}$$

where *Y* is subject i's bid or offer; *X* includes subject-specific variables that may affect the bid or offer. Variables in *X* are noted above. For the WTP equation, I use a Tobit specification since there are zero bids in the data.

Summary estimates of equations (1E) and (2E) are presented in Table E on the following page. In the trading specifications contained in columns 1 and 2, the emphasis is on the sign and magnitude of the response coefficients, as the treatment dummies merely control for starting points. These empirical results suggest that for certain subject pools, the propensity to trade and trading intensity are positively related. For nondealers, the logit coefficient estimate of 0.11 is significantly different from zero at the $p < .01$ level, suggesting market intensity has a positive influence on the propensity to trade mugs and chocolate bars. Alternatively, the effect of trading intensity for dealers (logit coefficient of 0.02) is considerably weaker and not significant at conventional levels ($t \approx 1.2$). For comparison purposes, the dealer trading intensity coefficient is statistically different from the nondealer coefficient estimate at conventional levels, which may suggest that some dealers have had substantial opportunity to interact in a market setting, rendering the marginal impact of another trade less important. If I examine a measure of the stock of market experience—the product of trading intensity and years of market experience—empirical results are qualitatively similarly.[16]

The auction specifications presented in columns 3 and 4 focus on bids (and offers) from the three goods auction (results are not qualitatively different across the one and two goods specifications). The empirical results strongly support the unconditional findings. For example, the coefficient estimate of trading intensity in the WTA specification is significantly different from zero at the $p < .01$ level and implies that a one standard deviation increase in intensity (≈ 5.2) is correlated with a \$3.70 decrease in WTA. Results from the WTP specification suggest that market intensity is not an important

[16] Note that given the design of the experiment the maximum probability the subject should trade is ½, not 1 as in the logit framework. Thus, the econometric model as specified is not consistent with the alternative hypothesis that, as experience intensifies, the probability of trading tends to ½. To rectify this potential shortcoming, I estimated a non-parametric model that involves mixing categorical and continuous kernels. Results from these models are consonant with the logit estimates.

marginal influence on WTP values. Again, I should note that if I examine a measure of the stock of market experience empirical results are qualitatively similarly.

Table E Summary Empirical Estimation Results

	Trading Treatments		Auction Treatments	
Variable	**Dealers Trade Function**	**Nondealers Trade Function**	**Nondealers WTA Function**	**Nondealers WTP Function**
Constant	-0.20(1.93)	-3.62(1.46)**	17.86(3.40)**	4.64(3.01)
Trading intensity	0.02(0.02)	0.11 (0.04)**	-0.74(0.13)**	0.09(0.60)
Yrs. of market experience	-0.06(0.05)	0.04(0.03)	-0.01(0.07)	-0.08(0.09)
Income	0.14(0.17)	0.26(0.18)	0.05(0.36)	-0.38(0.41)
Age	0.003(0.03)	0.001(0.02)	-0.03(0.07)	0.01(0.06)
Gender	-2.68(1.53)*	0.09(0.75)	2.10(2.20)	3.79(1.91)**
Education	0.69(0.26)**	0.05(0.21)	-0.02(0.03)	0.17(0.33)
Treatment D	-0.98(0.66)	0.15(0.72)	---	---
Treatment AP	---	-1.03(0.82)	---	---
Treatment DP	---	-0.55 (0.75)	---	---
R^2	---	---	0.37	---
N	58	121	55	47

Notes:
1. In the trading treatments, the dependent variable equals 1 if subject chose to trade, 0 otherwise. In the auction treatments, the dependent variable is the individual's offer (or bid) in the three goods auction. In the WTP function, I estimate a Tobit model and present marginal effects computed at the sample means. Gender = 1 if male, 0 otherwise; Treatment i = 1 if subject was in treatment i, 0 otherwise.
2. Standard errors are in parentheses beside coefficient estimates.
3. Sample sizes may not match with sample sizes in Table 1 due to some respondents not including income responses. Reported results omit these observations. If means are used to fill in the missing observations, results are not quantitatively or qualitatively different from the results reported.
4. **(*)Denotes coefficient estimate is significant at the $p < .05$ (.10) level.