

The Role of Preference Uncertainty in the Willingness to Pay - Willingness to Accept Disparity: An Experimental Test

David C. Kingsley*
Westfield State College

April 8, 2008

Abstract

Economists have long been interested in the difference between willingness to pay (WTP) and willingness to accept (WTA). The persistent finding of a large gap between WTP and WTA has prompted some to question whether observed choices are consistent with neo-classical economic theory. Although results are mixed in the literature one constant is that explicit market experience and the value disparity are negatively related. The focus of this research is the underlying behavior or decision making process responsible for the disparity. I consider the possible bias related to preference uncertainty. In particular preference uncertainty is expected to bias WTP down and WTA up resulting in the value disparity. Therefore a reduction in preference uncertainty, referred to as preference learning, may attenuate the disparity. Using a random price auction a split sample paired comparison experiment the effect of preference learning is isolated. Results are suggestive but are insufficient to eliminate the disparity.

*Assistant Professor, Westfield State College. Email: dkingsley@wsc.ma.edu

Keywords: Nonmarket Valuation, Cost-Benefit Analysis, Paired Comparison Experiments. This paper benefitted from discussions with Patricia Champ, Nick Flores, Jason Shogren and Donald Waldman as well as conference and seminar participants at the AERE sessions at the ASSA 2008 annual meetings and the University of Colorado at Boulder. All errors remain my own

1 Introduction

Neoclassical economic theory suggests that with small income effects and available substitutes an individual's Willingness to Pay (WTP) will be roughly equivalent to their Willingness to Accept (WTA) (Willig, 1976; Randall & Stoll, 1980; Hanemann, 1991). Despite this theoretical expectation a significant disparity between WTP and WTA is a common empirical reality (Horowitz & McConnell, 2002). The pervasiveness of this value disparity has led some researchers to question the assumptions of neoclassical economics. Notably, the assumption that preferences are independent from endowments would be in question if losses and gains are treated asymmetrically (Knetsch, 1989). This leads one to attribute the disparity to an *Endowment Effect* implying that losses from one's endowment detract from utility more than equivalent gains add to utility (Thaler, 1980). This behavior is often described as *Loss Aversion* and is used to explain why willingness to accept may exceed willingness to pay (Kahneman & Tversky, 1979).

Experimental economists have spent the 25 years since Kahneman et al.'s (1979) seminal work refining their experimental methods in order to explain this anomaly within neoclassical economic theory. Critics argue that choices not subject to the discipline enforced by the market may not accurately reflect preferences. As argued in Binmore (1999), behavior in experiments is not of concern for economists unless the behavior survives market discipline (Binmore, 1999). For instance, if preferences are modified by market experience then one-shot experiments provide little insight into market behavior (Knez, Smith, & Williams, 1985). Research has shown that individuals exposed to market like institutions behave according to neoclassical expectations. Rationality is, after all, a social phenomenon enforced by the market rather than an expectation of an isolated individuals' behavior (Cherry, Crocker, & Shogren, 2003). In the context of the current paper respondents with explicit market experience display no value disparity (List, 2003). It has also been hypothesized that through this experience individuals learn to

act on underlying preferences that satisfy standard neoclassical assumptions (Loomes, Starmer, & Sugden, 2003).

The focus of research must now investigate the underlying behavior or the decision making process responsible for the value disparity and its elimination. The power of the market to induce rational choices will surprise few economists. However, how individuals make decisions in lieu of market experience is still a concern. This is of particular importance in the nonmarket valuation literature and may be of concern in choices individuals make few times. This research begins to uncover the underlying behavior or the decision making process responsible for the value disparity and its elimination. The hypothesis is that preference uncertainty contributes to the underlying cause of the value disparity. Therefore, a reduction in preference uncertainty, referred to as preference learning, is hypothesized to reduce or eliminate the value disparity.

The nonmarket valuation literature has been wrestling with these questions for the last 15 years. The common theme in much of this literature is the role of preference uncertainty in valuation. Preference uncertainty implies that an individual's choice on a particular choice occasion represents a realization from some underlying valuation distribution (Thurstone, 1927; Li & Mattsson, 1995; Plott, 1996; Wang, 1997) or perceived utility (McFadden, 2001). Preference uncertainty can be measured using the error variance of the estimated random utility model (Swait & Adamowicz, 1996; Deshazo & Fermo, 2002; ?, ?). Another thread within this literature concentrates on theoretical implications such as how respondents with uncertain preference answer valuation question within choice experiments (Hoehn & Randall, 1987; Ready, Whitehead, & Blomquist, 1995; Li & Mattsson, 1995; Wang, 1997; Ready, Navrud, & Dubourg, 2001). These studies focus on the elicited WTP and predict that in the presence of uncertainty the WTP is biased downward.

There is a growing literature on the effect that preference uncertainty may

have on the value disparity. (Dubourg, Jones-Lee, & Loomes, 1994, 1997; Mueser & Dow, 1997; Kolstad & Guzman, 1999). This literature predicts that preference uncertainty will bias WTP down and WTA up thus producing the value disparity. Indeed, List (2004) states that preference uncertainty is the logical place to start investigating the decision making process underlying the value disparity (List, 2004). Therefore, this paper designs an experiment to test the hypothesis that a reduction in preference uncertainty, referred to as preference learning, will reduce the disparity.

Research using paired comparison experiments suggests that as respondents progress through a random sequence of paired choices they become more consistent, apparently *fine-tuning* their preferences (Brown et al., Forthcoming). This fine-tuning is accompanied by a significant reduction in the error variance of a random utility model, a reduction in preference uncertainty. This interpretation is consistent with the literature cited above that measures uncertainty using the scale of the error term and refers to reductions as preference learning. Brown et al. (2008) conclude that respondents may begin a hypothetical value exercise with imprecise preferences and that experience expressing those preferences across a variety of dissimilar goods may help respondents to fine-tune their preferences. In Kingsley and Brown (2008) paired comparison data is further shown to be consistent with a model of preference uncertainty allowing for preference learning (Kingsley & Brown, 2008).

In this paper the Willingness to Pay - Willingness to Accept disparity is again investigated. A split sample controlled experiment is introduced to isolate the effect of preference learning on the value disparity. For consistency with past research a commonly available University of Colorado at Boulder coffee mug is used within a random price auction modelled after Kahneman, Knetsch and Thaler 1990. The paired comparison experiments described in this paper will provide the opportunity for respondents to refine their preferences among a set of University of Colorado at Boulder souvenirs. Results

are suggestive and appear consistent with a Strategic Bias (Brown 2005) but are too weak to eliminate the disparity.

2 Background

The nonmarket valuation literature began to see a pattern form in the relationship between WTP and WTA in the 1970's. For example, it was shown that duck hunters were willing to pay an average of \$247 to prevent the loss of duck habitat but required \$1044 in compensation for its destruction (Hammock & Brown, 1974). There are many extensive reviews of WTP - WTA research (Horowitz & McConnell, 2002; Plott & Zeiler, 2005).

The earliest criticism of these findings stated the lack of incentive compatible experimental design and the stated preference nature of the choices. Using real choices over lotteries the disparity was found to persist (Knetsch & Sinden, 1984). The disparity is also found in real binary choice designs in which one group is given item A and participants are asked if they would like to trade for item B while another group trades B for A (Knetsch, 1989). Next, the single shot nature of the experiments was questioned. These experiments, it was argued, lacked the opportunity for respondents to learn the market. This set off a flurry of research in repeated auction market experiments. A variety of methods have been employed: Sealed Bid auctions, Vickrey (Second Price or N^{th} Price auctions), Random N^{th} price auctions and Becker - Degroot - Marschak (BDM) random price auctions. Note that these become increasingly incentive compatible as you move down the list see Plott and Zeiler (2005) for a comprehensive review.

Each of the auction designs employed, except the BDM, allow the market price to be determined by the participants (referred to as endogenous price auctions). The BDM random price auction, used in this paper, separates individual choices from price determination. An answer, buy (sell) not but (not sell), is elicited at each of a list of prices. After this is completed a

random price from this list is determined and becomes the market price. In a WTP auction any participant agreeing to buy at a price higher than this random price buys the item, at the market price.

Results of repeated auction experiments are mixed. Endogenous auctions tend to eliminate the disparity over successive rounds (Coursey, Hovis, & Schulze, 1987; Harless, 1989; Shogren, Shin, Hayes, & Kliebenstein, 1994; Shogren et al., 2001). In the majority of studies using exogenous price auctions, in particular the BDM random price auction, the disparity tends to persist (Knetsch, 1989; Kahneman, Knetsch, & Thaler, 1990; Boyce, Brown, McClelland, Peterson, & Schulze, 1992; Bateman, Munro, Rhodes, Starmer, & Sugden, 1997; Shogren et al., 2001). The anomaly in this discussion is the work of Plott and Zeiler (2005) who are able to eliminate the disparity using the BDM within a *revealed theory* methodology that controls for each aspect of subject misconception or confusion they identify. As Plott and Zeiler state: *subject misconception could be a multi-faceted and delicate issue and, without a theory about the nature of an operational definition of misconceptions our objective is to cast a large net in hopes of catching it using a revealed theory methodology.*

Mixed results in repeated auction markets are troubling. These experiments provide an incentive compatible choice environment within a market like institution. The persistence of the value disparity suggest that standard assumptions concerning individual preferences may not be readily justified. Why some methods work while others don't is unclear. However, these repeated auction markets lack true market experience. It has been argued that such behavior is not of concern to economists. Only behavior which persist in the market is consequential (Binmore, 1999). Fortunately, an important paper on the value disparity shows, using a field experiment, that explicit market experience and the value disparity are negatively related (List, 2003). This is not surprising considering that other work has shown the ability of a market institution to induce rational behavior (Cherry et al., 2003).

Unfortunately, how individuals make choices in lieu of explicit market experience is of concern for economists. Consider the environmental literature's reliance on stated preference methods for nonmarket valuation. What is the underlying decision making process behind the above results? Why does market experience induce rationality? Research has begun to address these questions in the context of the value disparity (Loomes et al., 2003).

Loomes et al. (2003) identify and test three hypotheses that may be at work. First, support is found for the *Shaping* hypothesis which states that valuations within experiments tend to converge to observed prices. Therefore, the results from endogenous price auctions may be susceptible to this behavior. The next two hypotheses imply that rational preferences exist but need to be uncovered consistent with the *Discovered Preference Hypothesis* (Plott, 1996). The *Market Discipline* hypothesis states that markets induce rationality because any other behavior is costly and thus corrected towards rationality. The market, in other words, simply rewards rational and punishes irrational behavior. The *Refining* hypothesis states that expressing your preferences, receiving feedback in an incentive compatible environment will uncover these same rational preferences. In other words market discipline is not necessary, rational preferences exist and simply need to be uncovered by the individual. Loomes et al. (2003) find that experience erodes the value disparity but are unable to distinguish between the *Market Discipline* and *Refining* hypotheses. The experiment in this paper further distinguishes between these competing hypothesis.

3 The Role of Preference Uncertainty

Preference uncertainty implies that an individual's choice on a particular choice occasion represents a realization from some underlying valuation distribution (Thurstone, 1927; Li & Mattsson, 1995; Plott, 1996; Wang, 1997) or perceived utility (McFadden, 2001). Therefore, the respondent becomes

a potential source of error within choice models. Respondent error and the existence of preference uncertainty is an increasingly important topic being investigated within choice experiments and valuation studies. Researchers commonly use the error variance, the variance of the error term within the random utility model, as a measure of preference uncertainty. The standard deviation of the error term is referred to as the scale of the model. The literature asserts an inverse relationship between individual choice consistency and the scale of a random utility model. Greater levels of error variance are associated with respondent fatigue, confusion or boredom (Deshazo & Fermo, 2002; Swait & Adamowicz, 1996) while lower levels are associated with preference learning.

Environmental economists have been on the forefront of research investigating the impact preference uncertainty may have on stated valuations (Hoehn & Randall, 1987; Ready et al., 1995). Hoehn and Randall (1987) noted that arriving at one's preferences for unfamiliar goods requires substantial effort. Under the assumption of risk averse agents any uncertainty will bias stated WTP downward. Ready et al. (1995) theorize an *Ambivalence Region* in which respondents must make difficult decision between tradeoffs. Depending on the heuristic decision rule the respondent's use, this region may systematically bias stated valuations. In particular, under a conservatism strategy, moves away from the status quo are avoided thus resulting in the status quo bias which will bias WTP downward. Practice expressing preferences is thought to reduce this Ambivalence Region and reduce this status quo bias.

Another thread in the environmental literature explores how underlying uncertainty effects the initial response to a valuation question (Li & Mattsson, 1995; Wang, 1997; Ready et al., 2001). Li and Mattsson (1995) developed a model of preference uncertainty in which respondents have incomplete knowledge of their preferences. Incorporating expressed uncertainty into their choice model is shown to lower estimated WTP. Wang (1997) de-

veloped a model of preference uncertainty in which each respondent has an underlying implicit valuation distribution. This model is used to explain why a respondent would use the *Don't Know/Unsure* option in dichotomous choice (DC) contingent valuation.

There is a large literature investigating the role that preference uncertainty has on the value disparity (Dubourg et al., 1994; Mueser & Dow, 1997; Dubourg et al., 1997; Kolstad & Guzman, 1999). The intuition in this literature is that uncertain buyers obtain draws on the lower end of their valuation distribution while uncertain sellers tend to obtain a draw on the higher end of their valuation distribution. The cumulative effect of this strategic bias results in a large disparity between a buyers WTP and a sellers WTA. Mueser and Dow (1997) provide evidence that greater uncertainty leads to a larger disparity, indeed no disparity is found within experiments using induced value tokens which have a known value. In fact List (2004) has argued that preference uncertainty is the logical place to start investigating the underlying behavioral cause of the disparity (List, 2004).

4 Paired Comparison Experiments

The paired comparison method has successfully been used in valuation models to estimate an Equivalent Surplus for an economic gain (Peterson & Brown, 1998; Champ & Loomis, 1998; Loomis, Peterson, Champ, Brown, & Lucero, 1998; Kingsley, 2006). The experiments have also been used to investigate individual decision making and in particular preference uncertainty and preference learning (Brown et al., Forthcoming; Kingsley & Brown, 2008).

Research using paired comparison choice experiments suggests that as respondents progress through a random sequence of paired choices they become more consistent, apparently *fine-tuning* their preferences. Brown et al. (2008) conclude that respondents may begin a hypothetical value exercise

with imprecise preferences and that experience expressing those preferences across a variety of dissimilar goods may help respondents to fine-tune their preferences. This fine-tuning is accompanied by a significant reduction in the error variance of a random utility model fit to this data, interpreted as preference learning in Kingsley (2008). This result implies that the data becomes less noisy over choice occasion and indicates that the respondent's are more able to discriminate between items. Furthermore, it is shown that choice experience and greater utility difference between pairs of items significantly reduces the probability of an inconsistent choice. It is also shown that the greater utility difference between the pair decreases (increases) the probability of reversing an originally consistent (inconsistent) choice.

Using these results it is hypothesized that respondents are able to refine their preferences within the paired comparison experiments. The experimental design within this paper is designed to test whether the preference learning within PCEs will reduce the value disparity. Note that PCEs do not provide market experience rather this is simply repetition.

5 Experimental Design

Students were recruited using the paid psychology research system on the University of Colorado campus. This system allows any student to register for any paid experiment happening on campus. This provides a wide range of students from all disciplines. Students signed up independently into scheduled sessions, these were attended by an average of 10 respondents per session during Spring 2007/Fall 2008.

The random price auction is used rather than an endogenous price auction for three reasons. First, endogenous price auctions, those allowing participants to determine the price, and in particular second price auctions create competition among bidders. This may induce individuals to win for winnings sake, an effect referred to as the *top dog effect* (Shogren et al. 2001).

Second, random price auction insure that even off the margin bidders, those whose value is substantially lower or higher than the determined price, have incentives to mark choices truthfully. Thirdly, it provides the most rigorous test of the hypothesis as it avoids any possible Shaping effects.

In the random price BDM auction, used in the paid mug round, buyers (sellers) chose to buy or not buy (sell or not sell) the mug at each listed price. The prices listed include \$0.00 to \$10.00 in intervals of \$.50. The exact script used is available in the Appendix. Buyers and sellers participate in separate sessions in both the control and the treatment groups (discussed below). The item involved in the WTP-WTA auction is a commonly available University of Colorado at Boulder (UCB) coffee mug that retails for \$4.95 in the bookstore.

The paired comparison experiment included 5 common University of Colorado at Boulder souvenirs including the coffee mug as well as five dollar amounts (1, 3, 5, 7 and 10). Items included a baseball hat (\$15.95), a 14 oz. Nalgene bottle (\$8.95), a key chain necklace (\$3.95) and a key ring bottle opener (\$1.95). Subjects were not informed of the market prices. Each participant made a total of 35 choices: 10 between two items and 25 between an item and a dollar amount. The experiment was completed online; each pair was presented in random order one at a time. Respondents were instructed to choose the item they would prefer if they could have either at no cost. Prior to the start of the experiment each item was shown to the respondents. During the experiment both a picture and a written description of the item was presented.

In order to ensure understanding of the BDM mechanism all respondents participated in 2 induced value rounds. These rounds hypothetically auctioned off tokens with known and certain values. For example, an individual in WTP induced value round would be asked to state their WTP for a \$4 token. Ownership of the token after the auction round entitled the individual to the token value. The incentives in these auctions are clear, respondents

Table 1: Experimental Design

	Control	Treatment
Part 1	Hypothetical Induced Value Rounds	Hypothetical Induced Value Rounds
Part 2	Paid Mug Round	Paired Comparison Experiment
Part 3	Paired Comparison Experiment	Paid Mug Round
Part 4	Demographic and Debriefing	Demographic and Debriefing

should choose to buy the token at any price less than \$4 and not buy at any price greater than \$4. Results from these rounds suggest a general understanding of the BDM auction mechanism.

A split sample experiment is used to isolate the effect of preference learning on the disparity. First, the results of Kahneman Knetsch and Thaler (1990) are replicated and referred to as the control group. A control group's experience consisted of 2 hypothetical induced value rounds followed by 1 paid mug round. Finally, each subject completed the paired comparison experiment. The treatment group's experience consisted of the same 2 hypothetical induced value rounds but was instead followed by the paired comparison experiment. After the completion of the paired comparison experiment subjects participated in the same paid mug round the control group saw before the paired comparison experiment. All sessions ended with demographic and debriefing questions. Table 1 summarizes the experimental design.

6 Results and Conclusion

To test our hypothesis, three test statistics are reported, a small sample t-test assuming unequal variances, a Wilcoxon rank sum test and a median test. The small sample t-test requires the assumption that both WTA and WTP are drawn from a normal distribution and is used to test the null hypothesis that the means are equal. The Wilcoxon rank sum test, alternatively known as the Mann-Whitney U-test, is a non-parametric test that requires no assumption on the underlying distribution. The null hypothesis in this test is that these values are drawn from the same distribution. Finally, the median test is another non-parametric test used to determine whether the data have a common median.

Again the hypothesis states the preference learning obtained in the treatment group will attenuate the value disparity. Therefore, a significant value disparity is expected in the control group consistent with the literature. The WTP is expected to increase in the treatment reflecting refinement while the WTA is expected to fall consistent with a reduction in strategic bias stemming from preference uncertainty. The cumulative effect will reduce and ideally eliminate the value disparity.

The results are in Table 2. In the control group the mean WTA is \$4.16 while mean WTP is \$1.99 providing a WTA/WTP ratio of 2.09. This disparity is shown to be significant using each of the three statistics. Compared to the control group the treatment WTP increased by 9% while WTA decreased by 9.6%, so that mean WTP is \$2.17 and mean WTA is \$3.76 providing a ratio of 1.73. Despite the slight convergence the disparity is shown to be significant.

Differences are also tested across the control and treatment groups to investigate whether there is a significant change in the WTP or WTA. Results in Table 3 suggest that the null hypothesis of equality cannot be rejected using any of the reported statistics in either the WTP or the WTA measures.

Results are suggestive, in that the WTP increased and the WTA de-

Table 2: BDM Auction Results

	Control ¹	Treatment
WTP		
Mean	\$1.99	\$2.17
Median	\$2.00	\$2.00
n	45	41
WTA		
Mean	\$4.16	\$3.76
Median	\$4.00	\$4.00
n	51	48
Mean WTA/WTP	2.09	1.73
Median WTA/WTP	2	2
t-test	(5.4) ^{***2}	(3.9) ^{***}
Rank sum test	(4.9) ^{***}	(4.4) ^{***}
Median test	(16.2) ^{***}	(11.2) ^{***}

¹Test statistics Parentheses. Null Hypothesis is equality between WTA and WTP

²Reject null hypothesis $P < .01$

creased, but the impact on the value disparity was very slight. Notably, upon further investigation it can be shown that the data in the PCE does not reflect learning, choice occasion is shown to have no impact on the error term. With this in mind no impact on stated valuation within the auction is expected. Future research must determine when PCE induce learning and when they do not. The broader questions regarding the ability of the market, and what aspects of the market induce rationality remain an important research topic.

Table 3: Within Treatment Results

	WTP	WTA
Mean WTP	0.92 ¹	1.11
Median WTP	1	1
t-test	(.68) ²	(1.03)
Rank sum test	(.48)	(.48)
Median test	(.29)	(.29)

¹All ratios reported as Control/Treatment

²Test statistics Parentheses

7 Appendix

This is the script for the WTP auction experiment in the Control group. The WTA script has the necessary changes. The treatment script simply switched the order of the paired comparison experiment and the paid mug round.

INSTRUCTIONS

This is an experiment in individual decision-making. We will conduct two hypothetical rounds and one binding round. The first two hypothetical rounds are meant to provide practice with and clarification of the procedures involved with this experiment, questions are encouraged. The third and final round is binding; the consequences of your decision during this round are real.

You have received an information packet that includes instructions for each round; each sheet represents a single round. Do not tear or separate the pages until instructed to do so. Do not share the information or your decisions with anyone else. We ask you not to communicate with others during the experiment or to react verbally to events. Please ask for clarification if these

instructions are unclear.

Your identification number is CP-10. You will be asked to enter this number into the computer portion of this experiment. All transactions will require this number as no other identifying information is collected. Keep this first page with you until the end of the experiment; it will act as your identification.

ROUND 1-Hypothetical

In this market the objects being traded are tokens. You are a buyer; you have an opportunity to buy a token, which has a value to you of \$3.00. It has this value to you because the experimenter will give you this much money for it. The value of the token is the same for each you. For each of the prices listed below please indicate whether you prefer to: (1) Buy a token at this price and cash it in for the amount of money indicated above, or (2) Not buy a token at this price. After you have finished, one of the prices listed below will be selected at random and any exchanges will take place at that price. If you have indicated you will buy at this price you will receive a token and will pay this amount of money; if you have indicated that you will not buy a token at this price then no exchange will be made and you do not pay anything.

Notice the following two things:

- (1) Your decision can have no effect on the price actually used because the price will be selected at random.
- (2) It is in your interest to indicate your true preferences at each of the possible prices listed below.

For each price indicate your decision by marking an X in the appropriate column.

	I Will Buy The Token	I Will Not Buy The Token
If the price is \$0.00		
If the price is \$0.50		
:		
If the price is \$9.50		
If the price is \$10.00		

Round two is the same except the value of the token is changed

ROUND 3

In this market the objects being traded are University of Colorado Coffee Mugs. You are a buyer; you have the option of buying this mug to take home by paying money for it. For each of the possible prices listed below please indicate whether you wish to (1) Buy the mug at this price and pay that amount of money for it, or (2) Not buy a mug at this price. After you have finished, hand Round 3 to the experimenter. Once all packets have been collected one of the prices listed below will be selected at random and any exchanges will take place at that price. If you have indicated you will buy at this price you will receive a mug and will pay this amount of money; if you have indicated that you will not buy a mug at this price then no exchange will be made and you do not pay anything.

Notice the following two things:

- (1) Your decision can have no effect on the price actually used because the price will be selected at random.
- (2) It is in your interest to indicate your true preferences at each of the possible prices listed below.

For each price indicate your decision by marking an X in the appropriate column.

	I Will Buy The Mug	I Will Not Buy The Mug
If the price is \$0.00		
If the price is \$0.50		
:		
If the price is \$9.50		
If the price is \$10.00		

You are now asked to complete a paired comparison experiment. This will consist of 35 choices between pairs of the items listed below. The items are all common University of Colorado souvenirs. Various dollar amounts will also be presented as items. You are asked to choose the item you would prefer if you could have either at no cost. That is, if the experimenter offered you both items but said you could keep only one of them; which would you choose?

- 1) A University of Colorado Bottle Opener
- 2) A University of Colorado Coffee Mug
- 3) A University of Colorado Baseball Hat
- 4) A University of Colorado Nalgene Bottle
- 5) A University of Colorado Key chain

Respondents then went to a website where they completed the Paired Comparison Experiment.

References

- Bateman, I., Munro, A., Rhodes, B., Starmer, C., & Sugden, R. (1997). A test of the theory of reference-dependent preferences. *The Quarterly Journal of Economics*, *112*(2), 479-505.
- Binmore, K. (1999). Why experiment in economics? *The Economic Journal*, *109*(February), 16-24.
- Boyce, R. R., Brown, T. C., McClelland, G. H., Peterson, G. L., & Schulze, W. D. (1992). An experimental examination of intrinsic values as a source of the wta-wtp disparity. *The American Economic Review*, *82*(5), 1366-73.
- Brown, T. C., Kingsley, D., Peterson, G. L., Flores, N., Clarke, A., & Birjulin, A. (Forthcoming). Reliability of individual valuations of public goods and private goods: Choice consistency, response time, and preference refinement. *Journal of Public Economics*.
- Champ, P. A., & Loomis, J. B. (1998). Wta estimates using the method of paired comparison: Tests of robustness. *Environmental and Resource Economics*, *12*, 375-386.
- Cherry, T. L., Crocker, T. D., & Shogren, J. F. (2003). Rationality spillovers. *Journal of Environmental Economics and Management*, *45*(1), 63-84.
- Coursey, D. L., Hovis, J. L., & Schulze, W. D. (1987). The disparity between willingness to accept and willingness to pay measures of value. *The Quarterly Journal of Economics*, *102*(3), 679-690.
- Deshazo, J., & Fermo, G. (2002). Designing choice sets for stated preference methods: The effects of complexity on choice consistency. *Journal of Environmental Economics and Management*, *44*, 123-143.
- Dubourg, W. R., Jones-Lee, M. L., & Loomes, G. (1994). Imprecise preferences and the wtp-wta disparity. *Journal of Risk and Uncertainty*, *9*, 115-133.
- Dubourg, W. R., Jones-Lee, M. W., & Loomes, G. (1997). Imprecise preferences and survey design in contingent valuation. *Economica*, *64*,

681-802.

- Hammock, J., & Brown, G. (1974). *Waterfowl and wetlands: Toward bioeconomic analysis*. Johns Hopkins Press.
- Hanemann, M. W. (1991). Wta and wtp: How much can they differ? *American Economic Review*, 81(3), 635-47.
- Harless, D. W. (1989). More laboratory evidence on the disparity between willingness to pay and compensation demanded. *Journal of Economic Behavior and Organization*, 11, 359-379.
- Hoehn, J. P., & Randall, A. (1987). A satisfactory benefit cost indicator from contingent valuation. *Journal of Environmental Economics and Management*, 14, 226-247.
- Horowitz, J. K., & McConnell, K. E. (2002). A review of wta/wtp studies. *Journal of Environmental Economics and Management*, 44, 426-477.
- Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1990). Experimental tests of the endowment effect and the coase theorem. *Journal of Political Economy*, 98(6), 1325-48.
- Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2).
- Kingsley, D. C. (2006). Multiple good valuation using paired comparison choice experiments. *University of Colorado at Boulder Working Paper*.
- Kingsley, D. C., & Brown, T. C. (2008). Preference uncertainty, preference learning and paired comparison choice experiments. *Submitted Manuscript*.
- Knetsch, J. L. (1989). The endowment effect and evidence of nonreversible indifference curves. *The American Economic Review*, 79(5), 1277-1284. Available from <http://links.jstor.org/sici?sici=0002-8282%28198912%2979%3A5%3C1277%3ATEEAE0%3E2.O.CO%3B2-Y>
- Knetsch, J. L., & Sinden, J. A. (1984). Willingness to pay and compensation demanded: Experimental evidence of an unexpected disparity in measures of value. *Quarterly Journal of Economics*, 99(3), 507-521.

- Knez, P., Smith, V. L., & Williams, A. W. (1985). Individual rationality, market rationality and value estimation. *The American Economic Review*, 75(2), 397-402.
- Kolstad, C. D., & Guzman, R. M. (1999). Information and the divergence between willingness to accept and willingness to pay. *Journal of Environmental Economics and Management*, 38, 66-80.
- Li, C.-Z., & Mattsson, L. (1995). Discrete choice under preference uncertainty: An improved structural model for contingent valuation. *Journal of Environmental Economics and Management*, 28, 256-269.
- List, J. A. (2003). Does market experience eliminate market anomalies? *Quarterly Journal of Economics*, Volume 118(Number 1), pp. 41-71.
- List, J. A. (2004). Substitutability, experience, and the value disparity: Evidence from the marketplace. *Journal of Environmental Economics and Management*, 47, 486-509.
- Loomes, G., Starmer, C., & Sugden, R. (2003). Do anomalies disappear in repeated markets. *The Economic Journal*, 113, 153-166.
- Loomis, J., Peterson, G., Champ, P., Brown, T., & Lucero, B. (1998). Paired comparison estimates of willingness to accept versus contingent valuation estimates of willingness to pay. *Journal of Economic Behavior & Organization*, 35, 501-515.
- McFadden, D. (2001). Economic choices. *The American Economic Review*, 91(3), 351-378.
- Mueser, P. R., & Dow, J. K. (1997). Experimental evidence on the divergence between measures of wtp and wta: The role of value uncertainty. *MU Working Paper*, 97-18.
- Peterson, G. L., & Brown, T. C. (1998). Economic valuation by the method of paired comparison, with emphasis on the evaluation of the transitivity axiom. *Land Economics*, 74(2), 240-261.
- Plott, C. R. (1996). Rational foundations of economic behavior. In K. Arrow, E. Colombatto, M. Perleman, & C. Schmidt (Eds.), (p. 225-250).

- London: Macmillan and NY: St. Martin's.
- Plott, C. R., & Zeiler, K. (2005). The willingness to pay/willingness to accept gap, the "endowment effect," subject misconceptions and experimental procedures for eliciting valuations. *American Economic Review*, *95*(3), 530-45.
- Randall, A., & Stoll, J. R. (1980). Consumer's surplus in commodity space. *The American Economic Review*, *70*(3), 449-455.
- Ready, R. C., Navrud, S., & Dubourg, W. R. (2001). How do respondents with uncertain willingness to pay answer contingent valuation questions? *Land Economics*, *77*(3), 315-326.
- Ready, R. C., Whitehead, J. C., & Blomquist, G. C. (1995). Contingent valuation when respondents are ambivalent. *Journal of Environmental Economics and Management*, *29*, 181-196.
- Shogren, J. F., Cho, S., Koo, C., List, J., Park, C., Polo, P., et al. (2001). Auction mechanisms and the measurement of wtp and wta. *Resource and Energy Economics*, *23*, 97-109.
- Shogren, J. F., Shin, S. Y., Hayes, D. J., & Kliebenstein, J. B. (1994). Resolving differences in willingness to pay and willingness to accept. *The American Economic Review*, *84*(1), 255-270.
- Swait, J., & Adamowicz, W. (1996). The effects of choice environment and task demands on consumer behavior: Discriminating between contribution and confusion. *Working Paper*, 96-09.
- Thaler, R. H. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior and Organization*, *1*, 39-60.
- Thurstone, L. (1927). A law of comparative judgment. *Psychological Review*, *34*, 273-286.
- Wang, H. (1997). Treatment of "don't know" responses in contingent valuation surveys: A random valuation model. *Journal of Environmental Economics and Management*, *32*, 219-232.
- Willig, R. D. (1976). Consumer's surplus without apology. *The American*

Economic Review, 66(4), 589-597.