January 2002

Value and Outcome Uncertainty as (Further) Explanations for the WTA vs WTP Disparity

William Neilson*

Michael McKee**

Robert P. Berrens***

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* Department of Economics, Texas A&M University; ** Department of Economics, University of Tennessee, *** Department of Economics, University of New Mexico. Address correspondence to Michael McKee, Department of Economics, University of Tennessee, Knoxville, TN, 37996; mmckee2@utk.edu . An earlier version of this paper was presented at Oak Ridge National Laboratory. We thank the seminar participants for helpful comments. We also thank Paul Brown for helpful comments and discussions. The usual caveat applies.

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Abstract: This paper contributes to the widespread discussion of the sources of the divergence between WTA and WTP values. The theoretical and empirical investigations show that value and outcome uncertainty offer an explanation for this disparity. Given a set of hypotheses generated by the theory, the paper investigates the disparity using an induced-value experimental laboratory setting. The incentive-compatible Becker-DeGroot-Marshak mechanism is employed to elicit the WTP and WTA values. Two conclusions can be drawn from the empirical results. First, the WTA - WTP difference is generally increasing in both value and outcome uncertainty. Second, a re-contracting option reduces the disparity when it arises from value uncertainty.

Keywords: Experimental, Uncertainty, WTP-WTA disparity.

JEL Codes: C9, D8

I. Introduction

The relationship between an individual's maximum willingness to pay (WTP) and minimum willingness to accept compensation (WTA) for the same change in a good or service has been the topic of considerable investigation.[1] The repeated finding from numerous survey-based contingent valuation field studies is that WTA and WTP are different, with WTA typically much higher than WTP.[2] These findings are supported by experimental laboratory investigations. There are some well-known examples: several field studies have shown that the WTA for various types of hunting permits is four to five times higher than the corresponding WTP; and, laboratory experiments that elicit values for lottery tickets and coffee mugs find that WTA is between 1.8 and 4.1 times higher than WTP. The persistence of such disparities, across numerous settings, has defied any single explanation. The issue also has considerable policy implications, as in the example of natural resource damage assessment and liability cases (Brown and Gregory, 1999).

Researchers have offered a number of competing explanations for why WTA exceeds WTP. Common explanations for the disparity include the income effect from standard consumer theory (Willig, 1976), an availability-of-substitutes argument (Hanneman, 1991; Shogren et al., 1994), "endowment effects" (Knetsch, 1989), and reference dependence preferences or "loss

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[1] Horowitz and McConnell (2002) report on an investigation of some 45 studies. In all, a significant disparity between WTA and WTP values was reported.

[2] The contingent valuation (CV) method employs constructed markets to elicit valuations from individuals for changes in nonmarket goods. As such, the good is often relatively unfamiliar to many of the respondents, as is the constructed market transaction itself. The CV method describes the posited change in the good and the essential elements of the pseudo-market transaction to the respondent, and then elicits valuation responses in the form of maximum willingness to pay or minimum willingness to accept compensation for the change. There are many different types of elicitation formats, the two most common are the open-ended , as in "state the maximum amount you would be willing to pay," and the dichotomous choice, as in "would you be willing to pay $x for the good?". The WTP - WTA disparity has been observed across the various elicitation formats.

aversion" (Kahneman et al., 1990).[3] The endowment effect explanation rests on the idea that when WTA is elicited the individual owns the good and is giving it up, and when WTP is elicited the individual does not own the good and must purchase it. The consumer theory explanations relies on the income effect from owning the good versus not owning it (indifference curve shifts), or the availability of substitutes when the good is sold, and the loss aversion explanation relies on the psychological finding that losses matter more than foregone gains (Thaler, 1980). More recently, Kolstad and Guzman (1999) argue that information acquisition for an unfamiliar good is costly and this drives a wedge between the buying and selling price of a good. Horowitz and McConnell (2002) use data from 45 studies to test between these explanations, and they find that the evidence does not support the consumer theory explanation. They report an important pattern in the data -- the WTA/WTP ratio is higher the less ordinary the good is, the less it is like an ordinary market good.

While it has never (to our knowledge) been tested, one can confidently predict that if a researcher were to elicit the value of a deterministic amount of money, WTA and WTP would be identical. The most an individual is willing to pay for $\$x$ is $\$x$, and the least the individual is willing to accept for $\$x$ is $\$x$. So, for WTA and WTP to differ, either the good must be non-monetary or non-deterministic in value. Since individuals may not know the utility they will receive from unfamiliar non-market goods, or market goods for that matter, WTA - WTP

[3] More specifically, Willig (1976) argues that for price changes in a market good, and given limits on the size of expected income effects, we should expect WTP - WTA disparities to be relatively small. Extending the case to quantity or quality changes in a nonmarket good, Hanemann (1991) and others have argued that WTP -WTA disparities may be substantial in some cases (e.g., absence of good substitutes).

disparities can be attributed to such uncertainty.[4]

The objective of this paper is to further explore, theoretically and empirically, the implications of the argument that WTA - WTP disparities arise because of uncertainty. We look at both value and outcome uncertainty. Value uncertainty arises when the subjective utility or value the good provides to the consumer is uncertain prior to the transaction being completed. Outcome uncertainty arises when the value of the good depends on a state of nature that is revealed only after the transaction has been completed.

We find that two models of behavior under uncertainty – expected utility with loss aversion and rank-dependent expected utility (RDEU) – make very similar predictions concerning the disparity. The predictions concern the *difference* between WTA and WTP, not the ratio, which has been most commonly reported historically, primarily out of convenience. Both theories predict that the WTA - WTP difference should increase with the spread of the random variable, and our experimental results support this hypothesis. The empirical investigation uses an induced-value laboratory setting in which the incentive compatible Becker-DeGroot-Marshak (BDM) mechanism is employed to elicit the WTP and WTA values from the subjects. Fitting a single choice parameterization of the loss aversion model to all of the data does not work so well, though, with WTA - WTP differences in one treatment conflicting with those from the other treatments. Finally, if subjects are allowed to insure ex post, thereby

[4] It may be asserted that goods such as coffee mugs (as in Kahneman et al, and Morrison) would not engender much uncertainty. However, we are speaking of subjective valuation here – how much individuals actually value a good. While a coffee mug may a have a certain (market) price, how much you actually value the good is unique to you. If an experimenter provides a mug and then offers to buy it back, the subject must deal with the potential for disappointment should she agree to sell it and then later regret the transaction (perhaps she later thinks the mug would look good on her desk). This is consistent with Horowitz and McConnell's (2002) finding that WTA/WTP ratios are higher when the good is less like an ordinary market good.

reducing the level of uncertainty, WTA - WTP differences fall.

II. Theory and Hypotheses [5]

Suppose that an individual is asked to report a valuation for the random variable $\tilde{z}$. Under the WTA scenario, the individual is endowed with $\tilde{z}$ and is asked for the least amount for which she would be willing to sell it. Thus, *WTA* solves

$$WTA - \tilde{z} \sim 0, \tag{1}$$

where "~" denotes the indifference relation and "0" denotes the degenerate lottery which pays zero with probability one. In contrast, under the WTP scenario the individual is not endowed with $\tilde{z}$ but is asked for the most she is willing to pay to purchase it. Thus, *WTP* solves

$$\tilde{z} - WTP \sim 0. \tag{2}$$

Obviously, if $\tilde{z}$ is deterministic, *WTA* and *WTP* are identical. If $\tilde{z}$ is not deterministic, *WTA - WTP* disparities arise. We derive properties of *WTA - WTP* differences for two different models and for two different types of probability distributions.

Loss aversion has been a prominent explanation for explaining *WTA - WTP* differences since Kahneman et al. (1990) published their study. Basically, loss aversion states that losses matter more than foregone gains. In its most simplistic formulation,[6] loss aversion can be

[5] The analysis here is in terms of the difference (WTA-WTP) rather than the ratio. There is some debate on this issue (see Brown, 1994). As will be clear from the theoretical discussion below, the case for WTP being below the individual valuation is as strong as the case for WTA being above. Use of the ratio implies that the WTP value is valid and this is not likely the case.

[6] Usually loss aversion is incorporated into a preference function with probability weights, such as RDEU, as in Tversky and Kahneman (1992). We use the expected utility formulation here to isolate the impact of loss aversion. Also, studies with loss aversion typically assume that utility is S-shaped, i.e. that utility is concave over

captured by a preference function with the form

$$V(\tilde{x}) = p_1 u(x_1) + p_2 u(x_2),$$

where

$$u(x) = \begin{cases} x & \text{if } x \geq 0 \\ \lambda x & \text{if } x < 0 \end{cases}$$

In this loss aversion specification, risk attitudes are determined solely by the parameter λ which measures how much losses matter more than corresponding gains.

Suppose that $\tilde{z}$ is a binary random variable with outcomes $z_H > z_L$ and corresponding probabilities p_H and p_L. From (1), *WTA* solves

$$\lambda p_h[WTA - z_H] + p_L[WTA - z_L] = 0,$$

or

$$WTA_{LA} = \frac{\lambda p_H z_H + p_L z_L}{\lambda p_H + p_L}.$$

From (2), WTP solves

$$\lambda p_L[z_L - WTP] + p_H[z_H - WTP] = 0,$$

which yields

$$WTP_{LA} = \frac{p_H z_H + \lambda p_L z_L}{p_H + \lambda p_L}.$$

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gains and convex over losses. We eliminate this feature so that all of the action comes from loss aversion alone and to allow closed form solutions in the calculations.

Note that *WTA* places greater emphasis on the higher outcome z_H and WTP places greater emphasis on the lower outcome z_L. Subtracting the two, we get

$$WTA_{LA} - WTP_{LA} = \frac{p_H p_L(\lambda^2 - 1)}{(\lambda p_H + p_L)(p_H + \lambda p_L)}[z_H - z_L]. \tag{3}$$

This expression shows that when decision makers are loss averse, the difference between WTA and WTP for binary lotteries is proportional to the difference between the high and low payoffs.

The same qualitative relationship between the WTA - WTP difference and the spread of the random variable holds for uniform random variables. Suppose that the random variable $\tilde{z}$ is distributed uniformly on $[z_L, z_H]$. Following the same logic as above, we find that

$$WTA_U = [\lambda z_H - z_L - \lambda^{1/2}(z_H - z_L)]/(\lambda - 1)$$

$$WTP_U = [\lambda^{1/2}(z_H - z_L) - (z_H - \lambda z_L)]/(\lambda - 1)$$

yielding

$$WTA_U - WTP_U = \frac{\lambda^{1/2} - 1}{\lambda^{1/2} + 1}[z_H - z_L]. \tag{4}$$

Once again, the difference between WTA and WTP depends on the spread of the random variable. In both (3) and (4), if there is no loss aversion ($\lambda = 1$), WTA and WTP are identical.

Surprisingly, this proportional relationship between the WTA - WTP difference and the spread of a binary random variable also holds for another class of preferences - rank dependent expected utility (RDEU) preferences. Suppose that an RDEU maximizer faces a binary lottery with payoffs $x_1 < x_2$ and corresponding probabilities p_1 and p_2. The RDEU preference function has the form

$$W(\tilde{x}) = g(p_1)u(x_1) + (1 - g(p_1))u(x_2),$$

where $g(p)$ is a probability weighting function with $g(0) = 0$, $g(1) = 1$, and $g'(p) \geq 0$ for all p, and $u(x)$ is a utility function. The key feature of RDEU is that the probability of the *lower* of the two outcomes is weighted according to the function g, and then expected utility is computed using the weighted probability. As with the loss aversion case, assume that $u(x) = x$ so that all of the individual's risk attitudes are determined by the probability weighting function, which is the distinguishing characteristic of RDEU.[7] Preferences are risk averse if $g(p) \geq p$ for all p, although this is not the pattern found in most experimental studies of the weighting function.[8]

Now suppose that $\tilde{z}$ is a binary random variable with outcomes $z_H > z_L$ and corresponding probabilities p_H and p_L. From (1), *WTA* solves

$$g(p_H)[WTA - z_H] + [1 - g(p_H)][WTA - z_L] = 0,$$

which yields

$$WTA_{RD} = g(p_H)z_H + [1 - g(p_H)]z_L.$$

From (2), *WTP* solves

$$g(p_L)[z_L - WTP] + [1 - g(p_L)][z_H - WTP] = 0,$$

which yields

$$WTP_{RD} = g(p_L)z_L + [1 - g(p_L)]z_H.$$

Note that WTA uses the transformed probability of the high outcome, $g(p_H)$, and WTP uses the transformed probability of the low outcome, $g(p_L)$. We get

[7] Under this assumption preferences match those in Yaari's (1987) dual theory.

[8] Studies of RDEU preferences have found that $g(p)$ typically overweights probabilities less than about 0.4 and underweights probabilities above 0.4 (Tversky and Kahneman, 1992; Camerer and Ho, 1994; Wu and Gonzalez, 1996; Prelec, 1998).

$$WTA_{RD} - WTP_{RD} = [g(p_H) + g(p_L) - 1][z_H - z_L]. \tag{5}$$

According to (5), the WTA - WTP disparity increases with the spread in the payoffs, and will be positive if preferences are risk averse so that $g(p) \geq p$ for all p.

An implication of the arguments made here is that stated WTP *understates* the individual's true willingness to pay while stated WTA *overstates* the individual's true willingness to accept. In all the cases above WTA places more emphasis on the highest outcome of the lottery (or its probability) and WTP places more emphasis on the lowest outcome. This is slightly different than the usual argument that WTA values are biased upward while WTP values are more likely to be true (Coursey, Hovis, and Schulze, 1986). This class of uncertainty is important if the transaction is irreversible. Why should the irreversibility matter? The above uncertainties can be overcome if the transaction is reversible at low cost (the risk is covered). If the transaction is irreversible, then the bid price (WTP) will be too low and the ask price (WTA) will be too high. A further implication is that, if we do not observe a difference here, uncertainty is not the cause of the disparity between WTA and WTP.

A few hypotheses present themselves. The first arises directly from equation (4).

H1: *An increase in the spread of a uniform random variable increases WTA – WTP.*

This is our most basic hypothesis – that increases in risk lead to increased WTA - WTP differences. The second hypothesis is that behavior in different choice settings should arise from the same underlying choice model.

H2: *WTA - WTP differences in different treatments are consistent with the same value of the loss aversion parameter λ.*

Finally, allowing subjects to re-contract by paying a small fee to reverse a decision after the uncertainty is resolved reduces the uncertainty subjects face. If WTA - WTP differences are caused by uncertainty, reductions in uncertainty should reduce the differences.

H3: *WTA - WTP differences are lower in the re-contracting treatments.*

Since it protects against irreversibility, to some extent the opportunity for re-contracting might be viewed as mimicking the substitution-availability argument (Hanemann, 1991). In the neutral context of an induced-value lab setting, where the treatments do not change the existence of substitutes, re-contracting is better characterized as reducing the ex ante uncertainty surrounding a given choice.

III. Related Literature

It is useful to briefly reconsider past studies on WTP - WTA disparities. The evidence provided by the literature on contingent valuation field studies and previous experimental work is consistent with our argument that the disparity is due to uncertainty regarding the value of the good. Table 1 summarizes the results from a subset of the literature. Large differences arise when the quality of the good and/or the subjective utility is likely to be uncertain ex ante. Many of the field studies focus on hunting permits and find that the compensation demanded (WTA) substantially exceeds the WTP value. Since the eventual outcome of a given hunting trip is highly uncertain, the value to the individual is subject to wide variation. In addition, there are generally few opportunities to purchase a replacement permit if you sell yours. Even in the laboratory, the types of lottery tickets offered are generally unique and the range of possible payoffs quite large. Thus, there is considerable uncertainty and the reported WTA-WTP differences reflect this.[9]

It is beyond the scope of this paper to present a complete literature survey (see Horowitz and McConnell, 2002 for a broad survey). However, a couple of recent papers are of particular relevance to our investigations. Adamovicz et al. (1993) investigate Hanemann's (1991) argument concerning the role of substitution possibilities as an explanation of the WTA-WTP disparity. In their experimental setting, the subjects are asked to state their hypothetical WTP and WTA (within-subjects design) values for a good for which the closeness of substitutes is determined by personal (observable) characteristics. Similar to Shogren et al. (1994), they find that increased substitution possibilities *reduces* the disparity between WTA and WTP but does not *eliminate* it. They conclude that something else is contributing to this disparity. We argue that it may be uncertainty concerning the good. In Adamovicz et al. (1993), the two goods are movie tickets to a one time showing of a film and tickets to a NHL playoff hockey game in Edmonton. In both cases, the individual's ultimate enjoyment of the event is uncertain at the time the purchase or sale decision is made. Thus, there is uncovered uncertainty. In an experimental setting similar to ours, Eisenberger and Weber (1995) investigate the behavior of the WTA/WTP ratio under varying conditions of uncertainty and ambiguity in lotteries. They find no interaction between ambiguity and WTA/WTP ratios (Eisenberger and Weber, p. 229).

[9] Note that we have developed our arguments in terms of the difference between WTA and WTP values. The literature has largely relied on reporting the ratios although Adamovicz et al. (1993) also conduct their analysis using differences.

IV. Experimental Design

In order to empirically test our hypotheses, we implement an induced-value laboratory experiment, with real payoffs (i.e., not hypothetical). In the experimental market the good is an asset (neutral) that has an uncertain redemption value or outcome (good vs. bad state of nature).[10] Subjects are given the value or outcome distribution in the form of a uniform distribution of values over an announced range or in the form of a lottery over two outcomes. Experimental treatments are the level of uncertainty using a mean-preserving spread, or variance in the lottery outcome, and whether the transaction is reversible. Reversibility is introduced via a re-contracting option at a cost. The primary null hypothesis is that the WTA vs. WTP disparity is increasing in uncertainty. A second null hypothesis is that the disparity between WTA and WTP declines when the transaction is reversible.

The experimental investigations are conducted in a computerized laboratory in which the subjects make individual decisions and enter these at a computer terminal.[11] The experiments employ a within-subject design to increase the statistical power of the data by reducing subject effects. Each subject is asked both the WTP and the WTA question. To control for order effects some subjects face the WTA setting first while others face the WTP setting first. This is a quantity change setting. The subjects either purchase a unit of the laboratory good (a coupon or lottery ticket to be redeemed at the end of the experiment) or they sell a unit of the laboratory

[10] Rather than using "homegrown" values, similar to a CV field survey, a pure induced-value setting is employed to reduce the effects of some of the issues raised elsewhere in the literature. Since the good has no intrinsic value, we are able to limit the effects of unease over the transaction itself as well as other context effects.

[11] Instructions are available from the corresponding author.

good.[12] Due to the within-subject design, subjects are initially sellers (to experimenter) and then buyers (from experimenter) or initially buyers and then sellers.[13] After the subjects have bought or sold the "good" the true value is revealed. At that point, if re-contracting is permitted the subject can choose whether to pay the cost of re-contracting to reverse the transaction.

The Becker-DeGroot-Marshak (BDM) mechanism is employed to elicit the WTP and WTA values from the subjects. This mechanism has been extensively investigated by Harrison (1986), McKee (1988), and by Irwin et al. (1998) and found to be incentive compatible at the low payoffs used in the laboratory and also cognitively transparent. Further, as Irwin et al. show, WTA and WTP values converge under the BDM when there is no uncertainty concerning the payoff from the good. Thus, if there are differences between WTA and WTP values, these are not due to the use of the BDM mechanism.

The experimental setting progresses as follows:

(1) The subject is asked for a bid or ask price for the neutral asset.

(2) The selling (or buying) price is revealed (random draw over a known distribution).

(3) If the subject's price is higher (lower) than the buying price, the subject can buy (sell) the ticket at the drawn price, otherwise the round is over for the subject.[14]

(4) In the treatments where re-contracting is offered, after the value of the neutral asset revealed (this is common knowledge), the subject can avoid some losses by re-contracting

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[12] We are following the classic induced value methodology (Smith, 1976) in which the laboratory commodity has zero intrinsic value. The value the subjects place on the good is induced by the fact that the experimenters will exchange the good for cash at the end of the session.

[13] To check for possible order effects an ABA design was conducted for some subjects. The results were unchanged and are not reported here since the sample sizes were small.

[14] Steps 2 and 3 constitute the BDM mechanism used to elicit the preferences of the subjects.

at a (known) cost.

All random values are drawn from known uniform distributions and the mechanics are accomplished through the use of bingo cages. The BDM price is drawn from a bingo cage (cage 1) as is the true value (cage 2). All subjects observe the draws and the distribution of the ball values prior to the balls being placed into the bingo cages. Draws are made with replacement.

Value uncertainty is induced by means of a mean-preserving spread (Rothschild and Stiglitz, 1970) while outcome uncertainty is induced by means of a lottery payoff. Experimental treatments are the level of uncertainty and whether the opportunity to re-contract is offered. When available, the re-contracting costs is 70% of the expected potential surplus from the transaction. Thus, while re-contracting is offered, the cost of doing so is quite high. The experimental design is reported in Table 2. Since the uncertainty treatment is a mean preserving spread, the mean values for all uncertainty treatments are constant. Further, to allow comparisons under re-contracting we set the relative cost of re-contracting at a constant fraction of the possible surplus from the transaction. That is, the re-contracting cost is higher when the value spread is larger. The number of subjects participating in each treatment is reported in the table (the first number is the number of subjects in the WTP-first sessions). These experiments took place over several weeks and to prevent information concerning the design from becoming widespread, the number of rounds varied from session to session and the actual treatments conducted were randomly distributed over time.

Briefly, the BDM bidding mechanism works as follows (for a more detailed description see Irwin et al, 1998). An individual is asked to state their maximum willingness to pay (WTP) for a good. After the individual has stated a WTP value, a random buying price is drawn from a known distribution. If the random buying price is below the individual's stated WTP value, the individual buys the good at the random buying price. Otherwise, the individual does not buy the good. The BDM bidding mechanism can be shown to be incentive-compatible. The intuition is straightforward. It is not in the individual's interest to understate WTP; if the random buying price falls between the stated WTP and the true WTP, the individual has foregone a beneficial trade. It is not in an individual's interest to overstate true WTP; if the random buying price is greater than the true value but less than the stated value, the individual will be required to buy the good at a price greater than true WTP. The same argument holds for the WTA decision. A proof appears in Irwin et al. (1998).[15]

In terms of the hypotheses set out above, we may view increasing uncertainty as increasing the range of payoffs in the continuous case and as higher odds of the large payoff in the lottery case. The re-contracting cost maps directly into the irreversibility argument. The higher the re-contracting costs, the less reversible the transaction. If no re-contracting is possible, the transaction may not be reversed and there is no covered uncertainty.

V. Experimental Results

Tables 3 and 4 report summary statistics of the WTA - WTP disparities for the eight treatments. The first hypothesis (***H1***) concerns the change in the WTA - WTP difference when subjects are faced with two different uniform distributions. The hypothesis states that the

[15] The BDM mechanism must be employed with care. The instructions were read aloud to the subjects and questions regarding the implementation of the mechanism (the use of the bingo cage and so on) were carefully answered. Casual observation supports the argument that the vast majority of the subjects understood the mechanism.

difference should increase with the spread of the distribution, and the raw data in treatments T2 and T4 supports this. The mean WTA - WTP difference for the uniform random variable over [0.31, 0.50] is 0.0195, and the mean difference for the uniform distribution over [0.11, 0.70] is 0.044. The uniform distribution with the larger domain generates a higher average WTA - WTP difference than the one with the smaller domain, as the hypothesis predicts.

Formal hypothesis tests confirm these conclusions. Comparing T2 vs T4, the *t*-statistic for difference of means is 2.48 (significance level = 0.01) and thus we cannot reject the hypothesis (at the 5% level) that the disparity is increasing in the level of uncertainty.[16]

The second hypothesis (***H2***) concerns whether all four treatments with no re-contracting could have been generated from the same underlying model; that is, is the data consistent with a single value of the loss aversion parameter λ. This hypothesis is addressed using Table 5. The first row of the table reports the means and standard errors for the no re-contracting treatments. These values are then used to construct 95% confidence intervals for each of the treatments, under the assumption that the data is distributed normally. These confidence intervals are reported in the second row. Each of the means is consistent with a value of λ which can be found using equation (4) for the uniform distribution treatments, T2 and T4, and using equation (3) for the binomial treatments, T6 and T8. The implied values are $\lambda = 1.51$ in treatment T2, $\lambda = 1.35$ in T4, $\lambda = 1.02$ in T6, and $\lambda = 1.18$ in T8. Each of these values can in turn be used to predict the WTA - WTP disparities in the other treatments, and the predicted WTA - WTP differences are shown in the last four rows of the table. The bold entries correspond to the predicted value in the

[16] For the case in which the WTA question is asked first, the *t*-statistic is 2.25. Thus the value of WTA-WTP is greater in T4 than T2. The divergence between WTA and WTP is increasing in the level of the uncertainty. The results are similar for the case in which the WTP question is asked first. The *t*-statistic is 3.31 and T4 > T2.

treatment used to identify that row, and the bold entries should closely resemble the entries in the top row in the table.

If a predicted WTA - WTP difference lies outside of the 95% confidence interval for that treatment, we can reject the hypothesis that the data in that treatment was generated by a model with the given loss aversion parameter. So, for example, the parameter $\lambda = 1.02$ was implied by the data in treatment T6, but it predicts values outside of the 95% confidence intervals for all three of the other treatments. We can, therefore, reject the hypothesis that all of the data was generated by a model with parameter $\lambda = 1.02$. The table shows that the data in T2, T4, and T8 could have been generated by the same parameter λ (= 1.18, implied by treatment T8), but that the data in T6 is inconsistent with any other treatment.[17]

Ex ante uncertainty may be offset through the opportunity to *re-contract* out of the transaction. In effect, the re-contracting offers a form of contingent contract (albeit with a cost) that can overcome value or outcome uncertainty concerning the utility the good may provide. The treatments T1, T3, T5, and T6 allowed the subjects to renege for a fee upon the realization of the value or outcome. Consider the case in which the uncertainty and re-contracting cost are low versus the case with low uncertainty but no re-contracting option. This involves comparing T2 vs T1. The hypothesis is that the difference between WTA and WTP will be smaller in T1. The *t*-statistic is 3.402 which is significant at the 0.01 level; thus, the evidence support the hypothesis

[17]The lottery in T6 has been studied extensively in the context of preference reversal experiments. In those, a $-bet with a low probability of a high payoff, like T6, is compared to a P-bet with a high probability of a low payoff, with the two gambles having the same mean (see, for example, Grether and Plott, 1979). Preference reversals occur because subjects generally prefer the P-bet to the $-bet in a direct comparison but assign a higher value to the $-bet. Tversky, Slovic, and Kahneman (1990) determine that preference reversals are not caused by intransitive preferences, but instead by subjects overvaluing the $-bet. Their study suggests that valuations of lotteries like T6 might be computed differently by subjects than valuations of other lotteries.

H3; re-contracting lowers the WTA-WTP difference.

In the high uncertainty case, comparing T4 vs T3 the result is similar. The *t*-statistic is 1.981 (significance level = 0.05); thus, the evidence again supports hypothesis ***H3***. In both cases, the value uncertainty is at least partially resolved by the opportunity to re-contract out of a bad purchase or sale. Further, the WTA-WTP spreads for T1 and T3 are not significantly different from zero. For value uncertainty, the possibility of re-contracting statistically eliminates the disparity between WTA and WTP values.

In the case of outcome uncertainty, the results are much less clear. Comparing T6 vs T5 the *t*-statistic is 0.537; thus, there is no evidence of a statistical difference due to the presence of re-contracting options. Similarly, the *t*-statistic for T8 vs T7 is 0.677, and we again cannot reject the null that there is no statistical difference in the results of these two treatments. Thus, in our setting, there is mixed evidence concerning hypothesis ***H3***; outcome uncertainty would appear to be <u>unresolved</u> through the possibility of re-contracting.

V. Conclusions

To summarize, two series of experiments were conducted to investigate the role of outcome and value uncertainty on the stated WTA and WTP values of individuals. The experiments are conducted in an induced value setting with real payoffs and an incentive compatible elicitation mechanism. Two conclusions can be drawn from the empirical results. First, the WTA - WTP difference is generally increasing in value and outcome uncertainty. Second, the re-contracting option reduces the disparity when it arises from value uncertainty. These results offer some support for the argument that uncertainties both in values and outcomes, can be a source WTP -

WTA disparity. An additional implication arises from the research reported here. The WTA values are increasing in uncertainty and the WTP values are *decreasing*.

It is interesting to note that our disparities between WTA and WTP are smaller than those reported in previous experimental literature. Most of the previous studies have investigated behavior over lotteries. In most cases, the range of gains in these lottery settings have been larger than those utilized here. The continuous setting is somewhat less common in the literature and so we have fewer comparisons. One explanation for the smaller disparities is that our setting is completely devoid of context. Even the "lottery ticket" setting downplays the gamble. The goals of the present investigation were to subject the hypothesis that outcome and/or payoff uncertainty underlies the divergence between WTA and WTP to a strong, clean test by limiting the context in the experimental setting and to determine whether the re-contracting opportunity offers a remedy to this divergence. Thus, context was minimized in the experimental setting. Further, the use of the BDM mechanism may contribute to smaller disparities since it induces incentive compatibility in preference revelation, while many previous studies have relied on hypothetical value settings (without incentive compatible mechanisms).

The results support the argument that uncertainty is a potential cause of the WTA-WTP disparity. To the extent that uncertainty can be reduced through the ability to re-contract, the disparity seems to be reduced. An avenue of further research is the sensitivity of the disparity to the costs (opportunity) for re-contracting.

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Table 1: WTA-WTP for Various Goods

Study-Authors	Good	WTA	WTP	WTA-WTP
Field Studies				
Hammack & Brown	waterfowl hunting	1044	247	797
Bishop & Heberlein	goose hunting permit	101	21	80
MacDonald and Bowker	industrial plant odor	735	105	630
Boyce and McCollum	bison hunting permit	12,233	215	12,018
Banford et al	fishing pier	120	43	77
Bishop et al	deer hunting permit	153	31	122
Laboratory Studies				
Knetsch & Sinden	lottery ticket	5.18	1.28	3.90
Harless	lottery ticket	na	na	2.7 (Ratio)
Kahneman et al.	coffee mug	5.78	2.21	3.57
Eisenberger & Weber	lottery ticket	6.11	4.23	1.88
Shogren et al.	food safety	3.50	0.90	2.60
Kachlemeier & Shehata	lottery ticket	11	6	5
Morrison	coffee mug	2.20	0.99	1.21

Source: Adapted from Brown and Gregory (1999). References appear in the bibliography.

Table 2: Experimental Design

	Uncertainty			
	Value Range		Lottery Probability	
	Low (.31-.50)	**High (.11-.70)**	**Low (.1) Win = 4.50**	**High (.5) Win = 0.90**
Recontracting Available	T1: 29, 21	T3: 21, 16	T5:24, 23	T7:21, 22
Recontracting Cost	0.07	0.21	0.07	0.21
No Recontracting	T2: 25, 26	T4: 18, 26	T6:20, 22	T8: 29, 26

Table 3 -- Value Uncertainty

Treatment	Description	WTA - WTP mean (std error)
T1	Value Uncertainty - Low Range Recontracting Offered	-0.03799 (0.0391)
T2	Value Uncertainty - Low Range No Recontracting Offered	0.0195 (0.0076)
T3	Value Uncertainty - High Range Recontracting Offered	0.03165 (0.1036)
T4	Value Uncertainty - High Range No Recontracting	0.0444 (0.0181)

Table 4 -- Outcome Uncertainty

Treatment	Description	WTA - WTP mean (std error)
T5	Low Probability of Success Recontracting Offered	0.0157 (0.097)
T6	Low Probability Success (.1) No Recontracting Offered	0.0169 (0.034)
T7	High Probability of Success Recontracting Offered	0.0304 (0.121)
T8	High Probability of Success (.5) No Recontracting Offered	0.0733 (0.027)

Table 5 – Actual vs. Predicted

	T2	T4	T6	T8
Actual WTA - WTP difference				
mean (std. error)	0.0195 (0.0076)	0.0444 (0.0181)	0.0169 (0.0340)	0.0733 (0.0270)
Confidence interval	(0.0043, 0.0347)	(0.0082, 0.0806)	(-0.0511, 0.0849)	(0.0193, 0.1273)
Predicted WTA - WTP difference				
$\lambda = 1.02$	0.0009	0.0029	**0.0160***	0.0089
$\lambda = 1.18$	0.0078*	0.0244*	0.1343	**0.0743***
$\lambda = 1.35$	0.0142*	**0.0442***	0.2447	0.1340
$\lambda = 1.51$	**0.0195***	0.0605*	0.3381	0.1829

5% confidence interval reported assuming normal distribution.
Bold corresponds to treatment used to determine λ.
Asterisks denote that the predicted value is within the observed confidence interval for that column.