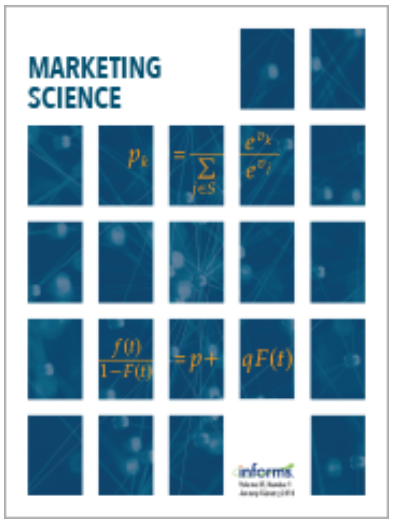

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Uncertainty, Risk Aversion, and WTA vs. WTP

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We examine a previously unstudied category of exchange items in which the true value is unknown to both the buyer and seller at the time of exchange but becomes known to both at a future time after the exchange. Real-world examples of such exchange items as in our study include forward contracts and fixed-fee turnkey contracts. We demonstrate that the discrepancy between the seller's willingness to accept (WTA) and buyer's willingness to pay (WTP) increases with (1) the level of uncertainty about the exchange item's value and (2) the exchange parties' level of risk aversion. In a series of studies, we manipulate and measure the level of uncertainty of the exchange item, measure the level of risk aversion of the exchange parties, and study the respective effects on decreasing the WTP while increasing the WTA.

Key words: exchange; valuation; willingness to pay; willingness to accept; buyer; seller; uncertainty; risk aversion
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Introduction

People prefer the status quo unless there is sufficient motive to change it (Gal 2006). A seller and a buyer will act to alter the status quo and enter into an exchange only if each sees a sufficient motive for doing so. If an exchange item's value is known with certainty, the buyer can bid up to that value, the seller can ask for a price down to that value, and they will each be better off if they can exchange. If the exchange item's value is uncertain, however, the benefits of entering into an exchange become ambiguous because the buyer faces the risk that the item he or she acquired will later not prove to be worth the price that was paid; the seller faces the opposite risk of undercharging. As a result, exchanges may be more difficult to achieve because of the desire by the buyer and seller to hedge against these risks, with the buyer initially bidding less than he or she might if the value was certain, and the seller demanding more. Hence as uncertainty in the value of an exchange item grows, so may the discrepancy between the seller's willingness to accept (WTA) and the buyer's willingness to pay (WTP).

The purpose of this paper is to explore in detail how mutual uncertainty about the value of an exchange item influences WTA-WTP discrepancies in consumer markets. Our contributions are threefold. First, we focus specifically on the previously unstudied category of exchange items in which the value is unknown to both buyer and seller at the time of exchange but becomes known to both at a future time after the exchange. Real-world examples of such exchange items as in our study include forward contracts and fixed-fee turnkey contracts. Our theory may also apply to the exchange of relatively new products when the value may be uncertain or unknown to consumers at first but becomes known later as products become more widespread in the market.

Second, we extend the existing literature on the process that produces WTA-WTP discrepancies by proposing that when the value of an item is uncertain, buyers and sellers focus on different tails of the value distribution: buyers focus on the post hoc risk of low valuations, and sellers focus on the post hoc risk of high valuations. These ideas build on previous work showing a differential focus of buyers versus sellers in an exchange (Birnbaum and Stegner 1979, Carmon and Ariely 2000, Nayakankuppam and Mishra 2005) by extending them to a new domain and explicitly applying them to the study of WTA-WTP discrepancies.

Third, we conduct a series of experiments to directly measure the effects of uncertainty in an exchange item's value on the magnitude of the WTA-WTP discrepancy when the exchange parties are risk averse. This is the first paper that directly manipulates and measures the uncertainty in the item's value, measures the exchange parties' risk aversion, and quantifies the respective effects on the WTA-WTP discrepancy. Two of our experiments involve actual exchanges with money.

Inertia, Uncertainty, and Risk Aversion

Central to this research is the hypothesis that WTA-WTP discrepancies often arise because of

mutual risk aversion by buyers and sellers, a trait that induces them to adopt different foci when assessing the value of potential exchange goods. By itself, the notion that buyers and sellers may have different foci in exchanges is, of course, not a new one. In an experimental study of automobile buying, for example, Birnbaum and Stegner (1979) found that from a range of estimates about the market value of an automobile, subjects who were assigned the role of a friend of the buyer put greater weight on the lower estimates, whereas those who were assigned the role of a friend of the seller put greater weight on the higher estimates. There is also evidence that sellers tend to focus more on the positive features of an exchange item and buyers tend to focus more on its negative features (Nayakankuppam and Mishra 2005). The focus on the foregone theory (Carmon and Ariely 2000) hypothesizes that each party tends to focus on what they give up in the exchange—buyers on the money and sellers on the item. As a result, they find evidence that WTP is more sensitive to reference prices, whereas WTA is more sensitive to the elaboration of the item's benefits (Carmon and Ariely 2000).

What is less clear from prior research, however, is *why* these differential foci occur. Carmon and Ariely (2000) and others, for example, argue that the explanation lies in the tendency for individuals to be loss averse when assessing the values (Kahneman and Tversky 1979, Ritov and Baron 1992, Samuelson and Zeckhauser 1988, Tversky and Kahneman 1991). Specifically, buyers and sellers each adopt their starting position as a reference point in negotiations, with the seller in possession of the good and the buyer in possession of her or his money. Because prospective losses loom larger than prospective gains, an asymmetry in valuation naturally arises: sellers command a higher price to "lose" an item than what buyers offer to "gain" the same item (Thaler 1980).

But while intuitively appealing, the loss aversion account has one major downside. It does not endogenously account for one of the known necessary conditions for this apparent asymmetric thinking: uncertainty about the value of the exchange item. In exchanges involving induced-value tokens that can be redeemed only at a predetermined fixed dollar rate, for example, there is typically no difference between WTA and WTP, suggesting that buyers and sellers do not adopt different foci in such cases (Kahneman et al. 1990). Likewise, van Dijk and van Knippenberg (1996) report experimental evidence of limited WTA-WTP discrepancies when the net gains from an exchange are clear (e.g., \$1.00 for \$1.50, or even one chocolate bar for 1.5 chocolate bars) but discrepancies when the net gains are difficult to compute. Although one could rescue loss aversion accounts in such cases by simply arguing that there are special "rules" that determine when buyers and sellers adopt different frames of reference when trading (e.g., they adopt common frames when trading money but different frames when trading tangible goods), such reconciliations are less than fully satisfying.

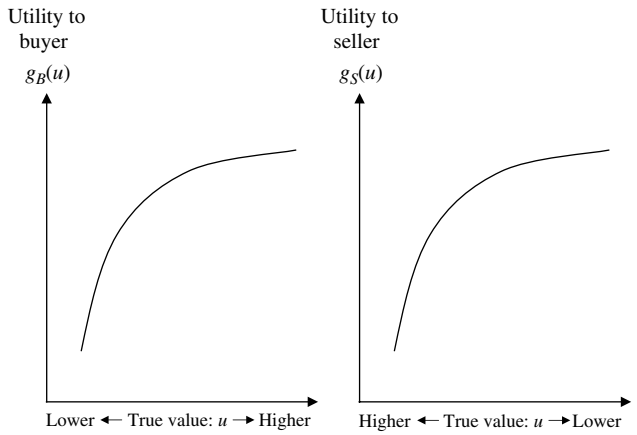
Such limitations of loss aversion as a general account for WTA-WTP discrepancies have prompted a number of authors to suggest that the psychological basis for the effect must thus lie elsewhere. Gal (2006), for example, argues that most of the effects attributed to loss aversion in fact have their origin in a more basic cognitive propensity for the status quo—an interpretation that naturally accommodates the observed dependence of WTA-WTP discrepancies on value uncertainty. Under Gal's account, WTA-WTP discrepancies do not arise from an explicit mental calculus in which buyers and sellers differentially contemplate their gains and losses from an exchange, but rather from a far simpler heuristic in which each acts (through his or her pricing demands) to prevent the exchange whenever the outcomes are uncertain or there is the possibility of later regret (Bar-Hillel and Neter 1996).

In this research we extend these ideas by exploring the viability of another explanation for WTA-WTP discrepancies that formally recognizes a dependence of such discrepancies on the existence of uncertainty in item valuations: the simple concept of risk aversion. Specifically, following Isik (2004), we argue that WTA-WTP discrepancies can be explained by assuming that buyers and sellers share the same goal in an exchange of maximizing their surplus utility. Both are risk averse, however, which causes them to be differentially influenced by different regions of the value distribution, given uncertainty about the utility of an exchange item. Specifically, buyers will focus on the bad outcomes that they may acquire, and sellers focus on the good outcomes that they may forfeit. This, in turn, leads to different prices being demanded by the seller and bid by the buyer. Note that this account makes the strong prediction that the size of the WTA-WTP discrepancy is conditioned not just by the existence of value uncertainty but also by its magnitude: the greater the variance of the value distribution, the greater the predicted WTA-WTP discrepancy.

A Model Based on Risk Aversion and Uncertainty of the Item's Value

We present a model to illustrate this idea. Our model is a simpler alternative to one proposed by Isik (2004), who offered a comparable mathematical demonstration of how WTA-WTP discrepancies could arise among rational but risk-averse traders who bid for an item of uncertain value.

Figure 1 **The Utility from Exchanging an Item with True Value u *Increases* with *Increasing* Realizations of u for the Buyer (Left) and *Decreasing* Realizations of u for the Seller (Right)**

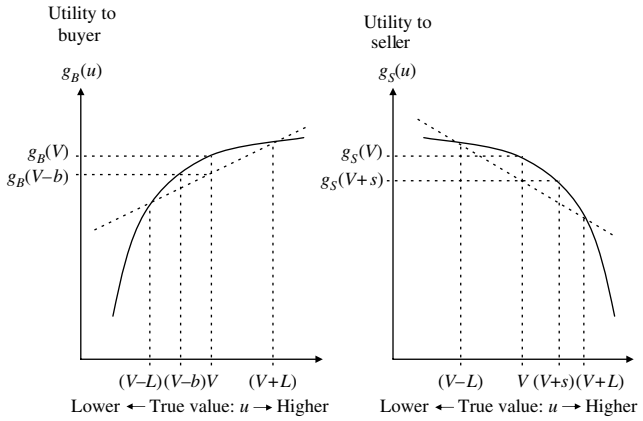


Suppose an exchange item has a true value $u = V + x$, where V is a prior expectation of the item's value and x is a random variable that is unobserved at the time of exchange but is resolved afterwards. For parsimony, we set both buyer and seller share the same prior expectations, V, and beliefs about the density function of x, $f(x)$. Let $g_B(V + x')$ be the utility of the exchange transaction to the buyer, given the realization x' of x. Similarly, let $g_S(V + x')$ be the utility of the exchange to the seller, given the realization x' of x. The buyer derives higher utility if the item she or he buys realizes a higher value, and the seller derives a higher utility if the item she or he sells realizes a lower value. Furthermore, suppose the buyer and seller is each risk averse in the outcome of the exchange, which can be represented as $g_B(u)$ increasing with *higher* u but at a decreasing rate and as $g_S(u)$ increasing with *lower* u but also at a decreasing rate, as shown in Figure 1 for the buyer on the left and seller on the right. This model is nonparametric, assuming only the concavity of the utility of exchange.

If we reorder $u = V + x$ in increasing order from the origin for both buyer and seller, $g_B'(u) > 0$ and $g_S'(u) < 0$; $g_B''(u) < 0$ and $g_S''(u) < 0$, as shown in Figure 2 for the buyer on the left and seller on the right.

If the exchange item's value were known with certainty to be V, the buyer will offer WTP $\leq g_B(V)$, the seller will ask for WTA $\geq g_S(V)$, and they will each be better off if they can exchange. Now suppose the item's value were to vary symmetrically between $V - L$ and $V + L$ around the same expected value V for some $L > 0$. Here, larger L reflects greater uncertainty about the true value of the item. Even with the same expected value V, because of the concavity in the buyer's function, the expected utility from the uncertain transaction, $E[g_B(V + x)] = \int_{-L}^{L} g_B(V + x) f(x)\, dx$, will be strictly less than the utility from the certain transaction $g_B(V)$ and equal to the utility from buying an item with a certain value

Figure 2 **The Utility from Exchanging an Item with an Uncertain Value Is Less for Both the Buyer and Seller**



Note. For the buyer (seller), it is equivalent to buying (selling) an item of lesser (greater) true value.

less than V of $V - b$ for some $b > 0$. That is, with uncertainty, the risk-averse buyer's WTP *decreases*; furthermore, the magnitude of the decrease in WTP becomes greater with higher levels of uncertainty as indicated by larger L. Similarly for the seller, because of the function's concavity, the expected utility from the uncertain transaction, $E[g_S(V + x)] = \int_{-L}^{L} g_S(V + x) f(x)\, dx$, will be strictly less than the utility from the certain transaction $g_S(V)$ and equal to the utility from selling an item with a certain value greater than V of $V + s$ for some $s > 0$. That is, with uncertainty, the risk-averse seller's WTA *increases*; furthermore, the magnitude of the increase in WTA becomes greater with larger L.

Risk aversion, as represented by the concavity of $g_B(u)$ or $|g_B''(u)|$ for the buyer and concavity of $g_S(u)$ or $|g_S''(u)|$ for the seller, is necessary for the uncertainty of the item's value to create a WTA-WTP discrepancy. As the buyer becomes more risk averse with greater $|g_B''(u)|$, the decrease in WTP should become greater in magnitude for a given level of uncertainty L. Likewise, as the seller becomes more risk averse with greater $|g_S''(u)|$, the increase in WTA should become greater in magnitude for a given level of uncertainty L. With increasing risk aversion, the WTA-WTP discrepancy should increase. If both parties were risk neutral, $g_B(u)$ and $g_S(u)$ would be linear functions, and there would be no WTA-WTP discrepancy in response to larger L.

Study One

We designed study 1 to directly manipulate the uncertainty of the exchange item, measure the exchange parties' level of risk aversion, and assess the respective effects on buyers' and sellers' prices.

The exchange items in this study were tickets that were redeemable for money. In effect, they were like

induced-value tokens in the Kahneman et al. (1990) study. Furthermore, as in van Dijk and van Knippenberg's (1996) study, the exact amount of money for which the tickets were redeemable was not known at the time of exchange. Our study 1 expanded on those two previous studies in two principal ways. First, rather than presenting a comparison between uncertain and certain monetary outcome conditions, we presented two different levels of uncertainty about the tickets' realized value to demonstrate that larger L increases the WTA-WTP discrepancy. Second, we also measured the exchange parties' level of risk aversion $|g''(u)|$, which was not done previously. We confirmed that exchange parties are generally risk averse and $g''(u) < 0$, and we demonstrated that the WTA-WTP discrepancy also increases with the level of risk aversion $|g''(u)|$.

Method

Ninety-eight undergraduate students participated in this study. Participants entered a room and took their seats. Every other participant was given a ticket so that half had tickets and the other half did not. They were all told that the tickets would be redeemable for cash.

They were then given a brief explanation, using simple numerical examples, of how market prices are determined by individual buyers and sellers. Because the participants were all business majors, this explanation was presumably a review of what they had already learned in a prerequisite economics course. It was explained that they were participating in an exercise in establishing a market price, and it was emphasized that one market clearing price would be established for the entire group. Buyers (sellers) who indicated a price equal to or above (below) the market price would be allowed to exchange at that market price. Buyers (sellers) who indicated a price below (above) the established price would price themselves out of the market and would not be able to exchange. It was iterated that any one person's price would not have any direct effect on the actual price that one would pay or receive, because all transactions would occur at the one established market price and that it was in their interest to reveal their true prices.

The study used a 2×2 between-subjects design. The first factor was their role as buyer or seller. Those who were given a ticket were sellers; those who did not have tickets were buyers. Sellers were asked to indicate "the lowest price that (they were) willing to accept in exchange for the ticket, so that (they) would be equally happy between receiving that amount and giving up the ticket, and keeping the ticket and not receiving the money." Buyers were asked to indicate "the highest price that (they were) willing to pay, so that (they) would be equally happy between paying that amount and receiving the ticket, and not receiving the ticket and keeping the money." The dependent measure was the price that they indicated as either buyer or seller.

To further make their choices incentive compatible, we told everyone that at the end of the session, one seller and one buyer would be chosen at random. If the chosen buyer (seller) indicated a price equal to or above (below) the market price, he or she would transact in an actual exchange at the market price.

We chose to align the participants' incentives by explaining the market pricing mechanism and by a random selection to engage in actual exchanges because these methods were conducive to our experimental setting where both sellers and buyers were present in the same location. Also, although the Becker et al. (1964) procedure has been shown to elicit incentive compatible prices in some cases, there is some question about the extent to which its desirable properties hold empirically (Wertenbroch and Skiera 2002).

The second factor was the level of uncertainty. In the high uncertainty condition, the participants were told that the ticket was redeemable for any dollar amount in increments of one dollar from \$1 to \$8. It was equally likely that the ticket would be redeemed for \$1, \$2, \$3, \$4, \$5, \$6, \$7, or \$8. In the low uncertainty condition, the participants were told that the ticket was redeemable for any dollar amount in increments of one dollar from \$3 to \$6. It was equally likely that the ticket would be redeemed for \$3, \$4, \$5, or \$6. In both the high and low uncertainty conditions, the actual dollar amount for which the ticket would be redeemed was to be determined randomly only after participants indicated their prices for selling or buying the tickets. In both the high and low uncertainty conditions, the expected value of the ticket V was equal to \$4.50. We manipulated the uncertainty around V, setting $L = 3.5$ in the high uncertainty condition and $L = 1.5$ in the low uncertainty condition. We predicted the WTA-WTP discrepancy to be greater (smaller) in magnitude with larger (smaller) L.

We manipulated uncertainty using lotteries with multiple discrete levels of positive payoffs rather than simple lotteries that have only one positive payoff and one zero payoff, as the latter can introduce an alternative explanation. Casey (1995) conducted an experimental study using a set of 12 simple lotteries with equivalent expected values of \$100 and varying levels of winning percentages, and showed that buyers' prices remained unchanged across the winning percentage range, whereas sellers' prices increased with increasing winning percentages. Although the author explained this pattern as a difference between buyers and sellers in how they encoded outcomes, there is also

perhaps a simpler alternative explanation based on a differential focus of buyers versus sellers. The buyer's price is differentially sensitive to reference prices (Carmon and Ariely 2000). Because the expected value would be a reasonable reference price for the lotteries, and they were all the same in this case, there would presumably be no difference in the WTPs across the winning percentage range. The seller's price is differentially sensitive to the item's benefits (Carmon and Ariely 2000). In Casey's (1995) study design, all subjects evaluated all twelve lotteries. When comparing multiple simple lotteries of similar expected value, people tend to prefer those with relatively higher winning percentages over those with relatively higher payoffs (Grether and Plott 1979). So when sellers consider the benefits of the lotteries, they would presumably ask for higher prices for the relatively more preferable lotteries with higher winning percentages. With simple lotteries, manipulating uncertainty also changes both of the attributes, and in different directions, thereby introducing a confounding effect.

In addition to the dependent measure of price, we also measured the participants' level of risk aversion. We adapted a simple lottery choice task from Fehr and Götte (2007) and Gächter et al. (2007) to measure risk aversion. After completing a filler task, the participants were presented six lotteries: four with positive expected value, one with zero expected value, and one with negative expected value. The outcome of each of the lotteries was determined by the flip of a fair coin: win money if heads, and lose money if tails. Each of the lotteries had a winning price of \$6, and the losing price varied from \$2 to \$7 in \$1 increments. For each lottery, participants indicated whether they would accept and play it or reject it. We measured risk aversion as the number of lotteries that respondents accepted out of the six: the fewer they accepted, the more risk averse they were and the larger the $|g''(u)|$.

Results and Discussions

The random assignment of participants to the uncertainty and role conditions resulted in 50 in the low uncertainty condition and 48 in the high uncertainty condition, with 51 buyers and 47 sellers. An analysis of variance (ANOVA) ($F_{3,97} = 5.94$; $p < 0.01$) of the exchange price on the level of uncertainty, their role as either seller or buyer, and the interaction of the two variables suggested that as expected, the sellers' price was higher than the buyers' price ($M_{\text{WTA}} = \$3.44$ versus $M_{\text{WTP}} = \$2.34$; $F_{1,97} = 13.82$, $p < 0.001$). Furthermore, the magnitude of the WTA-WTP discrepancy was greater ($F_{1,97} = 8.82$; $p < 0.05$) in the high uncertainty condition where L was larger, which is consistent with our theory.

In a second analysis, we added the level of the participants' risk aversion $|g''(u)|$ as a covariate. Across all participants, the number of lotteries that they accepted to play out of six ranged from none to six, and the average was 2.3, confirming general risk aversion; $g''(u) < 0$ because four of the six lotteries had positive expected values. The analysis of covariance ($F_{5,97} = 10.14$; $p < 0.001$) of the exchange price on the level of uncertainty L, their role as either seller or buyer, the interaction of the two variables, the level of risk aversion $|g''(u)|$ as a covariate, and the interaction of the covariate with the role of either buyer or seller replicated the same main effect of the role as buyer or seller ($F_{1,97} = 43.57$; $p < 0.001$), and of the interaction between uncertainty and the role of buyer or seller ($F_{1,97} = 9.04$; $p < 0.01$).

The covariate of risk aversion $|g''(u)|$ did not have a main effect ($F_{1,97} = 0.18$; $p = 0.68$). However, as our theory predicted, the interaction between risk aversion and the role of buyer or seller was significant ($F_{1,97} = 27.41$; $p < 0.001$). For buyers, those with greater $|g''_B(u)|$ and higher risk aversion responded to uncertainty with even *lower* WTP. For sellers, those with greater $|g''_S(u)|$ and higher levels of risk aversion responded to uncertainty with even *higher* WTA.

The results of study 1 generally support our prediction that the WTA-WTP discrepancy increases with higher levels of uncertainty in the item's true value (larger L) and higher levels of risk aversion on the part of the exchange parties (larger $|g''_B(u)|$ and $|g''_S(u)|$).

Study Two

Study 2 used exchanges that all involved actual monetary transactions rather than probabilistic exchanges as in study 1. Also in this study, we manipulated uncertainty L using consumption goods rather than monetary outcomes.

Method

Eighty-eight undergraduate students participated in this study. The exchange items in this study were tickets redeemable for candy, all with local retail prices of \$2.00. A separate pretest determined that a Cadbury milk chocolate bar with almonds and raisins, a Hershey dark chocolate bar, and Red Vines red twists licorice sticks were on average comparably desirable, rating, on a scale of 0 (do not like at all) to 5 (like very much), 2.7, 3.0, and 2.6, respectively. They were used as the candies for which tickets were redeemable in the main study.

The main study started with participants entering a room and taking their seats. They were then given a brief explanation, using simple numerical examples, of how market prices are determined by individual buyers and sellers. This step of the study was identical to that of study 1.

The main study used a 2×2 between-subjects design. One factor was the role of the participant as

buyer or seller. Every other participant was given a ticket, so half had tickets and were the sellers, and half did not and were the buyers. They were all told that the ticket was redeemable for one of three candy treats: a milk chocolate bar with almonds and raisins, a dark chocolate bar, or red licorice sticks. Then they were shown each of the three candies.

The market exercise was done in two conditions of uncertainty, high and low. In the low uncertainty condition, a throw of a fair die first determined that the tickets were redeemable for the milk chocolate bar with almonds and raisins. The participants then submitted their respective exchange prices after they knew the specific candy for which the tickets were redeemable. In the high uncertainty condition, participants were told that the ticket would be redeemable for one of the three candy bars, but which one specifically it would be, would be determined randomly by a fair die throw only after they submitted their prices. In both conditions, the exchange prices were elicited in the same manner as in study 1. Sellers were asked to indicate "the lowest price that (they were) willing to accept in exchange for the ticket, so that (they) would be equally happy between receiving that amount and giving up the ticket, and keeping the ticket and not receiving the money." Buyers were asked to indicate "the highest price that (they were) willing to pay, so that (they) would be equally happy between paying that amount and receiving the ticket, and not receiving the ticket and keeping the money." The price was the dependent measure.

To create a more realistic setting for exchange, we instructed participants to bring money to the session. After the market price was established, tickets were exchanged using the participants' own money. At the end of the session, all ticket holders, whether they were given the ticket or bought the ticket, redeemed their ticket for candy. Incidentally, the candy in the high uncertainty condition ended up being the red licorice sticks.

Our prediction was that the WTA-WTP discrepancy would be greater in the high uncertainty condition with larger L than in the low uncertainty condition with smaller L.

Results and Discussions

Twenty-two participants were in each of the 2×2 conditions. An ANOVA ($F_{3,84} = 8.60$; $p < 0.001$) of the exchange price on the level of uncertainty about the value of the ticket L, their role as either seller or buyer, and the interaction of the two variables suggested that, as expected, the sellers' price was higher than the buyers' price ($M_{\text{WTA}} = \$2.57$ versus $M_{\text{WTP}} = \$1.40$; $F_{1,84} = 20.36$, $p < 0.001$). Furthermore, the magnitude of the WTA-WTP discrepancy was significantly greater ($F_{1,84} = 5.45$, $p = 0.02$) when L was larger and participants did not know at the time of exchange for which of the three candies specifically the tickets would be redeemable, compared to when L was smaller and the ticket was known to be redeemable for the milk chocolate bar with almond and raisins. This outcome supported our prediction.

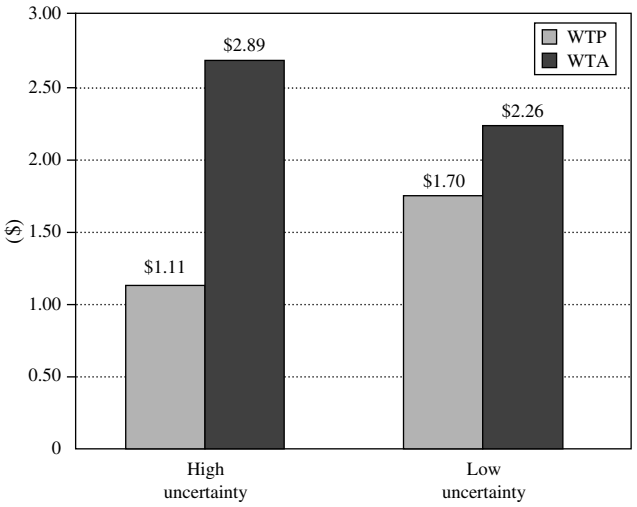
In their experimental studies, Kahneman et al. (1990) compared the volume of trade that would be predicted in the theoretical case of no WTA-WTP discrepancy, "V^*," to the actual volume of trade in their experimental markets, "V," and presented that the ratio V/V^* would be less than one if there were a WTA-WTP discrepancy.

In our study 2, each of the high and low uncertainty conditions had 22 buyers and 22 sellers, so 11 is the theoretically predicted volume of trade V^*. In the low uncertainty condition, the sellers' price was directionally higher than the buyers' price, but the difference did not reach statistical significance ($M_{\text{WTA}} = \$2.26$ versus $M_{\text{WTP}} = \$1.70$; $t = 1.57$, $p = 0.12$). There were 10 trades at the price of \$2.00, and $V/V^* = 0.91$ was less than one, but close. Presumably, there was not much uncertainty about the benefits of a milk chocolate bar with almonds and raisins, and that decreased the magnitude of the WTA-WTP discrepancy.

By comparison, in the high uncertainty condition, the sellers' price was higher than the buyers' price ($M_{\text{WTA}} = \$2.89$ versus $M_{\text{WTP}} = \$1.11$; $t = 4.75$, $p < 0.001$). There were six trades at the price of \$1.75, and $V/V^* = 0.55$ was less than one, indicating undertrading. The results are summarized in Figure 3.

The pretest showed that the three candy bars were all comparably desirable on average, but there was heterogeneity across individuals in the relative preference for the three candies. Also, at the individual level, there were very few who rated them all equally.

Figure 3 **WTA-WTP Discrepancy Is Significant and Greater When L Is Larger Than When L Is Smaller**



When it was not known at the time of exchange for which of the three candies specifically the tickets would be redeemable, buyers and sellers faced more uncertainty in the outcome of exchanging the ticket. Risk-averse exchange parties need greater motive to exchange when the value is uncertain and L is greater, which in turn increases the magnitude of the WTA-WTP discrepancy.

Study Three

When products are relatively new in the market, they share the characteristics of the class of items in our study. Those who have not yet adopted the product presumably do not know or are not certain about its benefits or value. However, they will learn the new product's true value in the future when it becomes widespread in the market. In study 3 we applied our model to the exchange of a relatively new product and compared the exchange prices between those who were relatively uncertain about the value versus those who were relatively certain.

In our study with undergraduate students, we chose digital cameras as the relatively new product. Digital cameras are relatively new for the undergraduate segment, as a significant percentage of them have not yet adopted and would be relatively uncertain about the product's benefits and value. An assumption here is that digital cameras will eventually reach as high a level of market penetration in this segment as film cameras did in the past, so that those who have not yet adopted would presumably learn the true value in the future as digital cameras become more widespread. Furthermore, there is also a significant percentage of the segment who have already adopted a digital camera and would serve as a comparison group to the nonadopters because the adopters would be relatively certain about the product's value.

Method

One hundred and sixty undergraduate students participated in a paper and pencil survey. The study used a 2×2 factorial design that manipulated one factor and measured another. We first asked the participants if they owned a digital camera. This dichotomous variable was the measured factor. Those who actually owned a digital camera would presumably be more familiar with the product category and be relatively certain about the value. Those who did not own a digital camera would presumably be less familiar and be relatively uncertain about the value.

The product stimulus in this study was a 5.0 megapixel digital camera, and we presented the participants a general product description along with a photograph of a specific Canon model. The other factor was the participant's role as either buyer or seller, which was manipulated and randomly assigned. Buyers were asked to indicate "the highest price that (they were) willing to pay, so that (they) would be equally happy between paying that amount and receiving the brand new Canon digital camera, and not receiving the Canon digital camera and keeping the money." Because some in the buyer condition may actually own a digital camera, and the marginal utility of a second camera may be lower than the first, we also asked those people to imagine a situation where they had lost their own cameras. We adopted this method for controlling for the effect of a second item from other experimental studies (see Okada 2006, Russo et al. 1998). Sellers were asked to imagine that they were given a brand new Canon digital camera and asked to indicate "the lowest price that (they were) willing to accept in exchange for the brand new Canon digital camera, so that (they) would be equally happy between receiving that amount and giving up the camera, and keeping the camera and not receiving the money." Again, as some in the seller condition may actually own a digital camera, we asked those people to imagine a situation where they had lost their own cameras. Their indicated exchange prices were the dependent measures.

Because we instructed the participants to consider the camera for their own use, rather than for a secondary market exchange, the value of the camera would be the benefit that they can expect from it. To measure the level of certainty about the item's value, we asked the participants to indicate how certain they were about how much usage and enjoyment they would get out of the digital camera on a 7-point scale of 0 ("absolutely uncertain") to 6 ("absolutely certain"). Presumably, uncertainty would be lower and L would be smaller among actual owners of digital cameras, and uncertainty would be higher and L would be larger among nonowners. We predicted the WTA-WTP discrepancy to be greater among nonowners (versus actual owners of the product category) and among people who were relatively uncertain (versus certain) about the value of the item.

Results and Discussions

Of the 160 participants, 80 actually owned digital cameras, and 80 did not. This was not a result of quota sampling but of chance. By the overall percentage ownership, the digital camera appeared to be a relatively new product for this segment. Overall the average exchange price was \$215.20. There was no difference in the prices between nonowners and actual owners of digital cameras ($M_{\text{nonowner}} = 214.16$ versus $M_{\text{owner}} = 216.24$; $t = -0.16$, $p = 0.88$). Overall the participants' level of certainty about the value of the digital camera was 3.81. Lower numbers indicate more uncertainty, and nonowners were more uncertain than

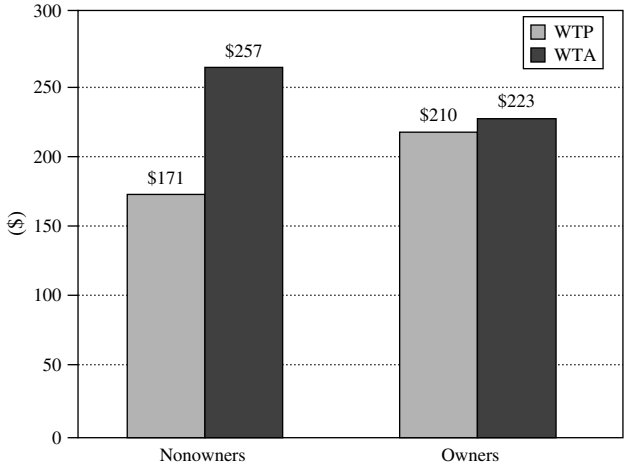
owners about the camera's value ($M_{\text{nonowners}} = 3.25$ versus $M_{\text{owners}} = 4.38$; $t = 3.98$, $p < 0.001$). This suggests larger L among nonowners and smaller L among owners, as we presumed.

An ANOVA ($F_{3,156} = 8.40$; $p < 0.001$) of the exchange price on the participant's actual ownership of a digital camera, their role as either seller or buyer, and the interaction of the two variables demonstrated a WTA-WTP discrepancy as expected ($M_{\text{WTA}} = \$239.97$ versus $M_{\text{WTP}} = 190.42$; $F_{1,156} = 16.19$, $p < 0.001$). Also, the magnitude of the WTA-WTP discrepancy was significantly greater ($F_{1,156} = 8.97$, $p < 0.01$) among nonowners who presumably are relatively uncertain about the camera's value, compared to actual owners of the product category, who presumably are relatively certain about the value. This outcome supported our prediction. Furthermore, by ownership condition, a WTA-WTP discrepancy existed only among the nonowners ($M_{\text{WTA}} = \$257.38$ versus $M_{\text{WTP}} = 170.95$; $t = 4.75$, $p < 0.001$), not among the owners ($M_{\text{WTA}} = \$222.57$ versus $M_{\text{WTP}} = 209.90$; $t = 0.76$, $p = 0.45$). The results are summarized in Figure 4. Based on revealed preferences, owners must value digital cameras highly enough to have bought one, and nonowners must value them low enough not to have bought one, which can explain why the owners' WTP is higher than the nonowners' WTP. However, the same principle would predict that WTA should also be higher for the owners, which was not shown here. We explain the WTA-WTP discrepancy among the nonowners based on larger L and relatively high uncertainty, and the absence of a WTA-WTP discrepancy among the owners based on smaller L and relatively low uncertainty.

Risk aversion is the other factor that we explored in this research; it could also differ between owners and nonowners to explain the observed effect on the relative WTA-WTP discrepancies. However, we conducted a separate test of 98 undergraduate students, which measured $|g''(u)|$ as we did in study 1, and showed no difference in the level of risk aversion. In fact, nonowners seemed to accept more risky lotteries, although the difference was not significant ($M_{\text{owners}} = 2.16$ versus $M_{\text{nonowners}} = 2.64$; $t = 1.32$, $p = 0.19$). There may be still other differences, such as wealth, between owners and nonowners, even among a relatively homogeneous group of college students.

We also directly measured how certain participants were about the camera's value, so we analyzed the effect of uncertainty L on exchange prices and the WTA-WTP discrepancy. First, a regression ($R^2 = 0.09$) of the exchange price on the participant's role as either seller or buyer demonstrated a higher price among sellers than buyers ($t = 3.94$; $p < 0.001$), thus replicating the WTA-WTP discrepancy. Next, we did a regression ($R^2 = 0.002$) of the exchange price on the participant's level of certainty about the value of the camera, which showed no main effect of L on the price ($t = -0.57$; $p = 0.57$). Finally, to assess the effect of L on the magnitude of the WTA-WTP discrepancy, we did a regression ($R^2 = 0.17$) of the exchange price on the participant's level of certainty about the value of the camera, their role as either seller or buyer, and the interaction of the two variables (see Baron and Kenny 1986). The significant interaction term ($t = -3.79$; $p < 0.001$) demonstrated that the WTA-WTP discrepancy was greater among those who were uncertain of the camera's value and for whom L was larger. This again supported our prediction that the magnitude of the WTA-WTP discrepancy is greater when there is more uncertainty about an item's value.

Figure 4 **WTA-WTP Discrepancy Is Significant and Greater Among Nonowners Than Owners of Digital Cameras**



General Discussion

Buyers will buy and sellers will sell only if the possibility of becoming better off from the exchange offers sufficient motive. When the exchange item's value is known with certainty to be V, the buyer can bid up to a price equivalent to his or her utility of V, $g_B(V)$; the seller can ask for down to a price equivalent to his or her utility of V, $g_S(V)$; and they will both be better off if they can exchange. However, if there is uncertainty about the true value of the item, the risk-averse buyer and risk-averse seller will each need greater motive to exchange for an uncertain exchange outcome—that is, lower WTP and higher WTA for the buyer and seller, respectively. We propose that uncertainty in an exchange item's value creates a WTA-WTP discrepancy between risk-averse exchange parties.

We take a previously unstudied category of products in which the value is unknown to both the buyer and seller at the time of exchange but becomes known to both buyer and seller at a future time after the exchange and demonstrate that the magnitude of the WTA-WTP discrepancy increases with higher level of uncertainty about the item's true value and

higher level of risk aversion for the exchange parties. In some contexts, asymmetric knowledge between the seller and buyer about an item's true quality contributes to a WTA-WTP discrepancy (Akerlof 1970). For certain products, such as protection of a national monument or the environment, the buyer's WTP may be limited by a budget constraint, whereas the seller's WTA faces no constraints, which could create a WTA-WTP discrepancy (Hanemann 1991). Also, when there is uncertainty about an item's market value, it would be economically rational for buyers and sellers to under- and overstate their prices, respectively, to defer any transaction to wait for a better exchange price (Kolstad and Guzman 1999, Zhao and Kling 2001). However, we examine cases in which the seller and buyer are equally (un)knowledgeable about the exchange item's true value at the time of exchange and furthermore where there is only a one-time opportunity for exchange. In this case, the aforementioned existing explanations for the WTA-WTP discrepancy are not applicable. The restriction to this narrowly defined category of items in our study allows us to propose a simple risk aversion-based explanation for the WTA-WTP discrepancy that complements such existing economic theories.

Across three different studies, we manipulated the uncertainty of the exchange item's value: higher versus lower variance in monetary outcomes, and uncertainty versus certainty in the identity of the ultimate exchange item. We also measured the uncertainty of the exchange item's value directly as well as by proxy using actual nonownership versus ownership in a product category, based on the assumption that nonowners would be relatively unfamiliar and uncertain about the product's value and owners would be relatively familiar and certain. In all three studies, we demonstrated that higher (lower) levels of uncertainty about the product's value result in a greater (smaller) WTA-WTP discrepancy.

Risk aversion was the premise for our theory of the WTA-WTP discrepancy based on the uncertainty of the item's value. Risk aversion is widely documented in economics and psychology. Our model incorporated risk aversion as the exchange parties' risk aversion in the exchange outcome and represented it with concave utility functions over the outcome of exchange. For the buyer, the utility of the exchange increases with *increasing* levels of the item's realized value but at a decreasing rate. For the seller, the utility of the exchange increases with *decreasing* levels of the item's realized value but also at a decreasing rate. In our study, we measured the level of the exchange parties' risk aversion, confirmed that there was general risk aversion, and furthermore demonstrated that higher (lower) levels of risk aversion contributed to greater (lesser) magnitudes of the WTA-WTP discrepancy.

By extension of our theory, among risk-seeking exchange parties, the WTA-WTP discrepancy should decrease when the exchange item's value is uncertain. Though risk seeking was not a pattern that we observed in our study, one future extension to this work may be either to find a segment that is risk seeking or to manipulate the exchange parties' risk preferences to become more risk seeking and demonstrate how the WTA-WTP discrepancy disappears and even reverses to the point at which WTP exceeds WTA.

We integrated existing theories that propound a differential focus of buyers versus sellers in an exchange (Birnbaum and Stegner 1979, Carmon and Ariely 2000, Nayakankuppam and Mishra 2005), and proposed more generally that buyers focus on the bad outcomes that they may acquire and sellers focus on the good outcomes that they may forfeit. An implication for the seller is that to elicit a higher price from the buyer, she would find it more effective to mitigate the item's downside value rather than to further improve the upside. From that perspective, satisfaction guarantees that entitle buyers to return unsatisfactory products and receive returns are not only helpful in signaling good quality to the buyer (Moorthy and Srinivasan 1995) but also in helping to mitigate the downside risk, which should be effective in increasing WTP. This marketing tool should be especially effective for new and unfamiliar products. Although we did not conduct a study to examine this, we would predict that an increase in the upside value would have a greater effect on increasing the seller's WTA than the buyer's WTP. A future study may compare the differential effects of an increase in the upside versus downside values on WTA and WTP, respectively.

We did not consider the dimension of social interaction between the buyer and seller, and another direction for future study is to examine WTP and WTA as a function of the relationship between the buyer and seller. From that perspective, trust may be a relevant social construct in exchange. The discrepancy between exchange prices may decrease with a higher level of trust between the two parties, as trust would presumably decrease uncertainty. Also, trust may build (see Ho and Weigelt 2005) between the buyer and seller when the exchange price discrepancy is smaller in magnitude.

We examined uncertainty in the value of an exchange item and the exchange parties' risk attitudes as factors that increase the difference between WTA and WTP. Understanding what creates and widens the magnitude of the WTA-WTP discrepancy is helpful because closing the differential will promote more exchanges that are mutually beneficial to buyers and sellers.

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