E C O N O M I C S B U L L E T I N

Experiments on the Divergence between Willingness to Pay and Willingness to Accept: The Issue Revisited

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Abstract

Many empirical studies have discovered large discrepancies between willingness to pay (WTP) and willingness to accept (WTA) measures. This paper revisits the WTP and WTA divergence issue using a non−hypothetical market experiment, actual products, cash, and exchange in a market setting. We find WTA/WTP ratios that are significantly lower than most such studies.

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1. Introduction

The divergence in willingness to pay (WTP) and willingness to accept (WTA) found in empirical analyses over the last three decades has troubled economists. For instance, Horowitz and McConnell (2002) revealed that the mean WTA/WTP ratio in their review of 45 studies is 7.17. The divergence is troubling because the interpretation of standard economic theory predicts that with small income effects, WTP and WTA should be equivalent, or at least within a tight bound (Randall and Stoll 1980). In addition, since valuation measures are used in many public-policy studies, these findings raise critical concerns about which procedure to use in practice (Shogren et al. 1994). Various explanations have been provided for these observed discrepancies. Hanemann (1991) attributes the discrepancy to the income and substitution effects while Thaler (1980) attributes the gap to an endowment effect. Horowitz and McConnell (2002) found, by reviewing several studies, that the less the good is like an ordinary market good, the higher is the ratio of WTA/WTP. Recently, Isik (2004) showed that uncertainty associated with characteristics or quality of the good is likely to contribute to the observed discrepancies between WTP and WTA.

This paper revisits this WTP and WTA divergence issue with a non-hypothetical market experiment using actual products (i.e., irradiated food product) and cash in an actual market setting using a dichotomous choice contingent valuation experimental study. We find WTA/WTP ratios that are significantly lower than most previous studies.

2. Experimental Method

We conducted face-to-face WTP/WTA experiments to a total of 484 randomly chosen consumers at selected stores of a supermarket chain in Austin, Houston, San Antonio, and Waco, Texas from March-June 2002. At each store, the WTP and WTA experiments were randomly assigned to about 13 to 15 respondents each.

We used the “Bid Distribution with Equal Area Bid Selection (DWEABS)” model to select the optimal bid values and sample sizes for each bid (see Cooper 1993 for details). The DWEABS uses an iterative procedure to select the optimal bid values as well as the sample sizes corresponding to each bid that minimizes the mean square error of the welfare measure. Since pretest data and total sample sizes are required as inputs for DWEABS model to calculate optimal bid values and sample sizes corresponding to each bid, we conducted a pretest on our experimental design at a local supermarket in College Station, Texas.

WTP experiment: After information about the nature of food irradiation (available from the authors upon request) was provided, we gave each WTP respondent a pound of non-irradiated ground beef and some money (first bid value = randomly picked from one of the bid values calculated from the DWEABS model) as a gift for participating in the study. The respondent was then asked his/her willingness to exchange the pound of non-irradiated ground beef and the first bid money for a pound of irradiated ground beef. If the respondent accepted the bid, the first bid value was recorded as his/her WTP value, and the exchange was made. However, if the respondent rejected the bid, he/she was again asked his/her willingness to exchange a pound of non-irradiated ground beef and a half value (second bid) of the money for a pound of irradiated ground beef. If the answer was "yes," the second bid value was recorded as his/her WTP value and the exchange was made.

WTA experiment**:** The design was similar to that of the WTP experiment except that the items to be exchanged were reversed. We gave each WTA respondent a pound of irradiated ground beef as a gift for participating in the study. The respondent was then asked his/her willingness to exchange the pound of irradiated ground beef for a pound of non-irradiated ground beef and some money (first offer value = randomly picked from one of the offer values calculated from the DWEABS model). If the respondent accepted the offer, the first offered value was recorded as the WTA value and the exchange was made. However, if the respondent rejected the offer, he/she was again asked his/her willingness to exchange a pound of irradiated ground beef for a pound of non-irradiated ground beef and money double the first offer value (second offer). If the answer was "yes," the second offer value was recorded as his/her WTA value and the exchange was made.

3. Empirical Models

In dichotomous choice contingent valuation models discrete dependent variables are measured on a nominal or ordinal scale. Both the Single Bounded (SB) and One and One Half Bounded (OOH) models are estimated using maximum likelihood. In the SB model, only the first dichotomous choice question is used. The log-likelihood function is:

(1) $$\ln L^s(\alpha,\beta)=\sum_{i=1}^{n}\left\{d_i^{yes}\ln\left(\Phi\left(\alpha-\beta A_i\right)\right)+d_i^{no}\ln\left(1-\Phi\left(\alpha-\beta A_i\right)\right)\right\},$$

where $d_i^{yes}=1$ if the *ith* response is "yes" and 0 otherwise, while $d_i^{no}=1$ if the *ith* response is "no" and 0 otherwise; the $\Phi(\cdot)$ is a normal cdf defined previously (Hanemann, Loomis, and Kanninen 1991).

In this paper, we modified the concept of double-bounded model, as suggested by Cameron and Quiggin (1994), by asking the second bid question only to respondents who answered "no" to the first bid question. Hanemann and Kanninen (1996) argued that even if there is gain in efficiency in doubled-bounded method, there is evidence that some of the responses to the second bid are inconsistent with the responses to the first bid due to the fact that two separate overlapping sets of bids are asked. Cooper and Hanemann (1995) also found, through a simulation analysis, that the OOH provides parameter estimates much closer in efficiency to those associated with the double bounded than the SB format. Thus, they argue that it may offer most of the statistical advantages of the double-bounded format without the response effects.

The log-likelihood function of the OOH model is:

$$\ln L = \sum_{i=1}^{N} \{ (I_1) \log \left[\int_{-\infty}^{z_1} \phi(z_1) dz_1 \right] + (1 - I_1)(I_2) \log \left[\int_{-\infty}^{z_1} \int_{z_2}^{\infty} g\left(z_1, z_2\right) dz_1 dz_2 \right]$$

$$+ (1 - I_1)(1 - I_2) \log \left[\int_{-\infty}^{z_1} \int_{-\infty}^{z_2} g\left(z_1, z_2\right) dz_1 dz_2 \right],$$

(2) where $\phi(.)$ is a standard normal density function,

$I_1 = 1$ if the answer to the first bid is yes, 0 otherwise,

$I_2 = 1$ of the answer to the second bid is yes, 0 otherwise.

Equation (2) is treated as a bivariate function.

4. Results

Table 1 summarizes the WTP and WTA values from the estimated SB and OOH models. The parameter estimates of the models are available from the authors upon request. Let WTP^1 (WTA^1) and WTP^2 (WTA^2) be the point estimates of WTP (WTA) from the first part and the second part of the OOH model, respectively. The pervasiveness of high WTA/WTP ratios has sustained interest in the WTP-WTA divergence issue for at least three decades. Horowitz and McConnell (2002) extensively reviewed and analyzed WTP/WTA studies and revealed an average WTA/WTP ratio of 7.17 for all goods (minimum 0.74 and maximum 112.67), a 10.41 ratio for public or non-market goods, a 10.06 ratio for health and safety goods, and a 2.92 ratio for ordinary private goods. They also found that ratios in real experiments are not significantly different from hypothetical experiments.

Hanemann (1991) pointed out that large divergences between WTP and WTA may be indicative not of some failure in the survey methodology but of substitution effects. However, Horowitz and McConnel (2003) show that the large discrepancies found in the literature are inconsistent with the standard neoclassical model calling into question the validity of most studies. At a minimum very large WTA/WTP ratios are certainly cause for some concern.

In contrast to most other values reported in Horowitz and McConnell (2002), our WTA/WTP ratios in both the SB (1.05 ratio) and the OOH (1.08 for first bid and 0.89 ratio for second bid) models are significantly lower. Our results are also in sharp contrast to the findings of other studies for food safety; Shogren et al. (1994), using a Vickrey auction, reported differences between WTP and WTA in the range of threefold to fivefold for a number of pathogens. They concluded that for non-market goods with imperfect substitutes (a good similar to ours which provides reduced risk from food-borne pathogens), WTP and WTA measures are significantly different, even after repeated market participation.

It is not clear why our WTA/WTP ratios are lower. One possibility is that this is due to the nature of our incentive compatible experiments. As discussed by Isik (2004), the WTP and WTA divergence found in many contingent valuation surveys have been viewed as the evidence of the failure of the survey methods (Diamond and Hausman, 1994). Horowitz and McConnell (2002) also found that the WTA/WTP ratio is highest for non-market goods, followed by ordinary private goods, and lowest for experiments involving some forms of money. Our experiments involved private goods and exchange of goods and money. More research, however, is needed in this area to test the robustness of our findings and to definitively assess if the nature and type of incentive compatible experiments can indeed have a significant effect on the WTA/WTP ratio. Moreover, as Isik (2004) discussed, future research should also consider alternative models that can take into account uncertainty over preferences and effects of endowments, learning and information.

Table 1. Summary of WTP and WTA Estimates from the Models

	Single Bounded Model		One and One-Half Bounded Model			
	WTP	WTA	WTP[1]	WTA[1]	WTP[2]	WTA[2]
Point Estimate	76.96	81.56	75.43	81.63	78.51	69.49
90% Confidence Interval*	62.42-99.10	68.23-103.60	61.94-95.25	67.96-104.43	55.85-210.80	34.46-92.35
WTA/WTP Ratio	1.059		1.082		0.885	

*calculated using Krinsky and Robb's (1986) Monte Carlo simulation technique.

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