Willingness to Accept, Willingness to Pay and the Income Effect

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The disparity between willingness to pay and willingness to accept in experimental and survey settings remains a troubling anomaly and a seeming challenge to the consumer model of Willig, Randall and Stoll, Madden, and others. In a typical experiment, a subject is given a good, like a coffee mug, and asked how much he would sell it for. This is his willingness to accept (WTA), also called compensation demanded or willingness to sell. Another subject is not given a mug and asked how much he would pay for one, his willingness to pay (WTP). Willingness-to-accept is almost always higher than WTP, around seven times as much on average (Horowitz and McConnell). The research that this disparity has attracted seems useful both for understanding preferences and for establishing the reliability of survey methods such as contingent valuation.

Although there are several explanations of the disparity, often expressed as a ratio of WTA to WTP, our interest lies with the neoclassical explanation provided by W. Michael Hanemann in 1991. Building on Randall and Stoll, Hanemann shows that the disparity (*i.e.*, the ratio WTA/WTP) can be large and still consistent with neoclassical preferences when there are few substitutes for the studied good. Hanemann demonstrates that for exogenous quantity changes, the difference between WTP and WTA depends ratio of the ordinary income elasticity of demand for the good to the Allen-Uzawa elasticity of substitution between the good and a composite commodity. When the elasticity of substitution is low, this ratio will be large. The ratio WTA/WTP will then also be large[1].

[1] In a recent publication (Hanemann, 1999), Hanemann appears to consider the possibility that preferences are reference-dependent, and that this may cause disparities between WTA and WTP.

This result is intuitive. When goods have many substitutes, gains or losses from increments of the good are constrained by the available substitutes, and the difference between WTA and WTP will necessarily be small. When a good has few substitutes, a gain may be moderately valuable but a loss could be irreplaceable, and the difference between WTA and WTP would then be large.

The drawback with this explanation lies not with its logic but with the difficulty of refutation. Since most of the goods studied are not available in markets, market measures of elasticity of substitution are not readily available. Introspection about their magnitudes is also weak. Indeed, it is easy to imagine an alternative evolution of this literature in which economists might have decided to use estimates of WTA and WTP to *infer* substitution elasticities rather than the other way around.

Fortunately, the WTA/WTP ratio can also be expressed in terms of the income effect on WTP, as shown by Robert Sugden. Let $V(y,x)$ be the (indirect) utility when y is income and x is the a rationed good, such as a public good. When the endowment is (y_0,x_0), the individual's willingness to pay for an increment $x_1 - x_0$ is defined by $V(y_0 - WTP(y_0),x_1) = V(y_0,x_0)$. Willingness to pay is a function of income and x_0 and x_1, but in this example we can suppress arguments x_0 and x_1. Similarly, when income is y_1, we have $V(y_1 - WTP(y_1),x_1) = V(y_1,x_0)$. Willingness to accept is defined by $V(y_0+WTA,x_0) = V(y_0,x_1)$. Set $y_1 = y_0+WTA$.

Our main observation comes from $V(y_0+WTA - WTP(y_0+WTA),x_1) = V(y_0+WTA,x_0) = V(y_0,x_1)$. The first equality follows from the generic definition of

WTP, the second from the specific definition of WTA. Equality of the first and third expressions implies y_0+WTA – WTP(y_0+WTA) = y_0, or WTP(y_0+WTA) = WTA.[2]

A first order approximation of WTP(y+WTA) yields $WTA \approx WTP + WTA \frac{\partial WTP}{\partial y}$.

Rewriting this leads to the basic relationship derived by Sugden:[3]

$$\frac{\partial WTP}{\partial y} \approx 1 - \frac{WTP}{WTA} \tag{1}$$

Note that in our example, WTA is defined for initial income of y_0. Thus, all elements of (1) are evaluated at the same income.

This expression allows an intuitive appreciation of the implications of an observation on a {WTA,WTP} pair. The ratio WTP/WTA can be used to predict $\partial WTP/\partial y$, which we label the *income effect*. The derivative $\partial WTP/\partial y$ is the change in willingness-to-pay for the good in question when income increases. Equation (1) can also be used to predict the income elasticity of WTP, $\eta = (y/WTP)\partial WTP/\partial y$, if we have data on WTP and income. (Note that this is not the ordinary income elasticity of demand.)

Our key result is that the components of equation (1) are intuitive, while the components of the Hanemann result (Allen-Uzawa elasticity of substitution; ordinary income elasticity of demand) are either unobservable or rarely measured. Economists have a decent body of market and survey evidence on the magnitude of the income effect.

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[2]These relations are used implicitly in Bateman *et al.* to control for income and substitution effects in experimental tests of reference dependence versus neoclassical preferences. Holding the income and substitution effects constant, they find disparities in WTA-WTP that cannot be explained by neoclassical theory. Morrison also uses these relations in a test of reference dependence as an explanation of WTA-WTP disparities.

[3] The accuracy of this approximation depends on the utility function and its parameters, with the exact income effect sometimes exceeding the approximation, and sometimes the reverse.

This allows a test of the neoclassical model. Almost no evidence is available for the elasticity of substitution.

It follows that even intuition will be stronger for the components of equation (1). A WTA/WTP ratio of two – a common finding for goods such as mugs and candy – suggests that if someone won $100 in a lottery, she would spend $50 more on the good in question. This seems like quite a lot of income to commit to pens or coffee mugs! Another way to understand the implication concerns the outcome of an experiment. A WTA/WTP ratio of two suggests that if a WTP experiment were to be repeated with respondents having $100 more income, their average WTP for the experimental good would be *$50 higher*. Again, this result is simply not credible.

Mental experiments are more conclusive with the income effect than with the elasticity of substitution, where we can only reject extreme quantities. If we believe that there are fewer substitutes available for public parks than for mugs, for example, then the WTA/WTP ratio should higher for parks than for mugs. But exactly how much higher, or what the ratio's magnitude should be for either these goods alone is hard to know. The reason is that the numerical value for the elasticity of substitution is simply unknown.

In this paper, we address the divergence between WTA and WTP empirically. We look at reported values of WTA/WTP and the income effect ($\partial WTP/\partial Y$) or income elasticity of willingness to pay, η, and ask whether the observations are consistent with equation (1). Regression analysis is not possible since there are relatively few experiments that report all of the needed quantities. But a more general conclusion is possible because there do exist sufficient observations of each of the constituent parts. Our approach differs from others (for example, Boyce *et al.*) in that we do not offer an

alternative hypothesis for the observed WTA/WTP data. There are several such hypotheses. Our purpose is not to establish the correctness of reference dependence or other psychology-based theories of preferences but rather to test the standard neoclassical model and to investigate whether the observations need an explanation other than the one proposed by Hanemann.

The basis of our empirical work is a comprehensive dataset on experimental and contingent valuation studies that provide WTA/WTP (Horowitz and McConnell). Our technique is to use these data to calculate the implied income effects ($\partial WTP/\partial y$) and income elasticities and then to compare these with magnitudes from the literature. We propose three sources for comparable income effects.

1. Intuition: Do the values of $\partial WTP/\partial y$ implied by the WTA/WTP ratios appear intuitively plausible?

2. WTP Studies: Are the income effects and elasticities implied by the WTA/WTP ratios in accord with the values found in the literature? In this section we compare values estimated from regressions of WTP on income, across a range of studies, with the values implied by the WTA/WTP ratios in the comprehensive dataset.

3. WTA/WTP Studies: Are the income effects and elasticities implied by the WTA/WTP ratios in accord with the values estimated from those same experiments and surveys? This is a close to an internal test as possible. In this section we compare values estimated from regressions of WTP on income with value implied by the WTA/WTP ratios in the same studies.

To preview our conclusions, we find that the WTA/WTP ratios provided by our comprehensive literature search imply income elasticities and income effects that are

implausibly high; much higher than income effects found in the literature; and much higher than income elasticities estimated in the set of studies from which the WTA/WTP results are drawn.

Based on the evidence below, it is difficult to accept the idea that the observed ratios of WTA/WTP, garnered from a remarkably large and diverse set of studies, are consistent with a standard neoclassical model. Substitution among goods seems an inadequate explanation for the divergence between WTA and WTP.

1. WTA/WTP Data

The WTA/WTP data are drawn from Horowitz and McConnell, who list usable results from 45 studies, many of which contained multiple experiments. Those studies draw on a remarkable range of goods: chocolates, pens, mugs, movie tickets, hunting licenses, visibility, nuclear waste repository siting, nasty-tasting liquids, pathogen-contaminated sandwiches, and many others. As Horowitz and McConnell remark, there is probably no other economic issue that has been experimentally studied across such a wide variety of goods.

The variable that is the focus of our analysis is mean-WTA/mean-WTP where means are taken over all subjects in the experiment. Most studies report only mean-WTA/ mean-WTP even when WTA and WTP values were collected from all individuals, so that it would conceivably have been possible for the studies' authors to have calculated the mean of individual WTA/WTP ratios. Only two studies reported both the mean of individual ratios and the ratio of mean-WTA/mean-WTP. In both of these the mean of individual ratios was higher than the ratio of means.

Data are summarized in Tables 1 and 2. Readers are referred to Horowitz and McConnell for discussion of how the data were compiled.

Perhaps the most interesting finding for this paper's purpose is that on average, the less the good is like an "ordinary market good," the higher is the ratio. The ratio is highest for public and non-market goods (including health and safety items), next highest for ordinary private goods, and lowest for experiments involving forms of money, either lotteries or timing studies. Horowitz and McConnell further find that a generalization of this pattern holds even when survey design features are accounted for.

This pattern, seen in Table 2, is notable primarily because it appears consistent with an elasticity-of-substitution argument. Higher ratios are observed for goods that most economists believe have fewer substitutes: Non-market goods likely have fewer substitutes than ordinary market goods; health and safety items probably have similar substitution possibilities with public and other non-market goods; lotteries have readily identifiable substitutes. Unfortunately, this is as far as the elasticity of substitution argument takes us.

2. Intuitive Plausibility

Sugden's result in equation (1) shows that WTA/WTP (or WTP/WTA) can be used to calculate the implied effect of income on willingness to pay, $\partial WTP/\partial y$. This derivative is the amount by which willingness to pay increases when income increases. Since willingness to pay is bounded above by income, the sum of these marginal effects across all goods must equal one. Strictly speaking, $\partial WTP/\partial y$ is a measure of the income effect for the particular good described in the experiment, not simply for a generic good

of that type. But even for generic goods, the implied $\partial WTP/\partial y$ numbers are high.

For example, in the experiments with mugs, a respondent who reported a WTA/WTP ratio of 3 would be revealing $\partial WTP/\partial y = 0.67$, or a willingness to spend 67 percent of any extra income she might receive on mugs. Consider what this means. If she won $100 in the lottery, she would spend $67 of it on mugs. If she received an unexpected salary bonus of $100, she would spend $67 of it on mugs. Since it is typical to think of respondents in different experiments as roughly similar, then if one WTP experiment were conducted with the janitorial staff at a school and another were conducted with teachers, and if teacher salaries were a mere $100 higher, average WTP would be $67 higher with the teacher group. These thought experiments show just how extreme this WTA/WTP result is when viewed as an approximate income effect.

Table 3 provides the implied values of $\partial WTP/\partial y$ for four types of goods using equation (1).[4] Values for $\partial WTP/\partial y$ range from 0.52 to 0.90. The implied value for all goods is 0.86. This is the average income effect over all types of goods studied. This average income effect shows even more clearly how extreme are the values of the WTA/WTP ratios. It is implausible that respondents would be willing to allocate more than 80 percent of an extra dollar to any of these experimental or survey goods, given the rich set of goods that could spend this money on in the real world.

Among the goods types shown in Table 3, ordinary private goods and lotteries might appear to have the most substitutes and health and public goods the fewest.

[4]There are two basic decisions that are made to calculate the quantities in this paper: whether to weight the results of the individual experiments and whether to use the mean of the WTA/WTP ratio to calculate $\partial WTP/\partial Y$ or use each experiment's observations on WTA/WTP to calculate a mean $\partial WTP/\partial Y$. We use weights to account for different number of subjects in each experiment and because of possible correlation of experiments within a study; see Horowitz and McConnell for details. We use the mean of the WTA/WTP ratio because it reduces variability, especially in calculations of income elasticities, without substantially changing our conclusions.

Indeed, this is the interpretation that neoclassical demand theory would put forth for the high WTA/WTP ratios. Yet that theory would also suggest that for any of the health or public goods, in the form described in the experiment, respondents would give up over 90 percent of a lottery winning or salary increase, for example, to pay for those goods; respondents who were richer than average by $100 would have a willingness to pay for these goods that was $90 higher than average. Again, this implied income effect suggests implausible preferences.

These arguments about the intuition for WTA/WTP are convincing in their own right. Nevertheless, we next look at some income effects measured in the literature. These show that the WTA/WTP measures are not merely out of line with basic economic understanding but with other experimental results as well.

3. Valuation Studies

Although a large number of contingent valuation studies have been conducted, information about the effect of income on WTP or other measures of value remains diffuse. In this section, we draw on the few reviews and broad conclusions that are available.

The most frequently estimated contingent valuation model is a linear-in-income random utility model, which implies a zero income effect: $\partial WTP/\partial y = 0$. This assumption most likely reflects a belief that for the range of incomes in any set of respondents, differences in WTP by income are minuscule, rather than a belief that $\partial WTP/\partial y$ is strictly zero. Such low income effects are, as we have shown, incompatible with the observed WTA/WTP ratios. In the studies gathered by Horowitz and

McConnell, just 4.9 percent of the WTA/WTP's are less than or equal to one.

The remaining WTP studies (those that allow that $\partial WTP/\partial y \neq 0$) typically report results either as income elasticities or as both elasticities and income effects. Income elasticity can be calculated directly from the income slopes, given observations on willingness to pay and income. Hence the informational content of income elasticities of willingness to pay is almost the same as the income slopes. Nonetheless, because there is more evidence and discussion of these magnitudes in the literature, it is most informative to explore the results through the income elasticities. These are not ordinary income elasticities and they do not need to sum to one. For WTP, the sum-to-one restriction applies to $\partial WTP/\partial y$. Because of these differences, intuition about WTP elasticities is weak, as Flores and Carson note; intuition about WTP income effects is much stronger. This is different from ordinary demand studies, where intuition about elasticities is probably the stronger feature.

McFadden and McFadden and Leonard, in a study of wilderness areas in the U.S., find a low income elasticity of willingness to pay. McFadden and Leonard find income elasticities of WTP from -0.203 to 0.371; they settle on an estimate of 0.269 (p. 184). McFadden points out that reporting and grouping errors would attenuate the effect of income but could not account solely for the very low elasticities, and raises the issue of whether such a low elasticity reflects rational preferences.

Kristrom and Riera provide a similar but more pervasive findng. Surveying the available studies of WTP for environmental goods in Europe, they regress WTP as a share of income on income:

(2) $$WTP/y = a + by$$

and find that b is significantly less than zero. A coefficient of less than zero implies that the income elasticity of WTP is less than one.

Flores and Carson develop a model that explains the income elasticity of willingness to pay. They conclude that there is no *a priori* reason why income elasticities of demand need be greater than one for luxury goods. However, they note that a number of studies have shown income elasticities of willingness to pay less than one.

To see how these results compare with our WTA/WTP values, we constructed income elasticities by type of good using the formula:

$$\eta = \frac{\bar{y}}{\overline{WTP}}\left(1 - \frac{WTP}{WTA}\right) \tag{3}$$

This calculation requires observations on income and mean willingness to pay by type of good. Mean WTP was reported for 169 of the 201 experiments. Income is not uniformly available for the studies that we have accumulated. Instead of income for individual studies, we use the mean over observations of income that are available. In 1983 prices, mean income for the respondents is $21,500. The results are not sensitive to the income variable within a broad range of incomes. All values are converted to 1983 dollars. The mean WTP values are reported in Table 4.

The implied elasticities are in Table 5. The implied elasticities are quite high, ranging from 80 for health and safety to over 3000 for lotteries. The elasticity computed for all goods is 123.[5] These are much higher than the values reported in the literature. Citing empirical studies on the environmental Kuznets curve, the demand for recreation

[5] As Flores and Carson have shown, little can be said about the relative size of the elasticities. That is, goods that might appear necessities (health) might have a low income elasticity for the good, but not necessarily for the willingness to pay for the good. Nothing about the Flores and Carson results would lead us to expect income elasticities of willingness to pay of the size we find implied by the WTP/WTA ratio.

sites, and contingent valuation studies. Flores and Carson observe that income elasticities of WTP tend to be less than one. McFadden and McFadden and Leonard are concerned with the finding that elasticities are less than one. Similarly Kristrom and Riera find elasticities of WTP for environmental goods that are less than one. Thus, Table 5's elasticities are not consistent with the prevalent empirical findings in the literature. The lowest value implied by the WTA/WTP ratio is 80; the highest value in the literature is about 1.

4. Internal Evidence

Our discussion so far has dealt with the inconsistency between plausible expectations of behavior or estimated relationships between WTP and income, and behavior implied by the WPA/WTP ratio. In this section we look at the internal consistency between the income slopes and elasticities that are estimated from survey responses and the income slopes and elasticities implied by equation (1). We do this for the set of studies whose authors have estimated income elasticities or slopes. The internal evidence uses only a subsample of the data because only 27 experiments have reported income effects or income elasticities of WTP. But it allows the testing of two independently estimated responses for consistency

Table 6 lists the estimated income effects or elasticities based on coefficients in regressions of WTP on y, ln(WTP) on ln(y), or WTP on ln(y). These are the studies' values, reported by the study authors. Income effects are small or even negative. The elasticities are uniformly less than one and many are not significantly greater than zero. The measured income effects and elasticities are similar to those found in the rest of the

literature and described in the previous section. They are not, however, consistent with the values implied by equation (1), as we show next.

We compare the estimated elasticities with elasticities implied by the ratio of WTA to WTP. Many studies had more than one experiment and thus report multiple WTP and WTA/WTP results. Let a case represent the k^{th} experiment in the j^{th} study. We calculate the income elasticity of WTP as:

$$\eta_{jk} = \frac{y_j}{WTP_{jk}}\left(1 - \frac{WTP_{jk}}{WTA_{jkh}}\right) \tag{4}$$

Note that in a few cases mean WTP is not available (only the ratio is reported) and in other cases, income is not available (just the income effect.) When income is not available, we approximated the income by taking the unweighted mean of income from the observations in Table 6. When mean WTP is not available, we do not calculate the elasticity implied by the ratio; these studies are not included in Table 6 or 7. All calculations are based on income and willingness to pay in 1983 dollars.

Table 7 provides the comparison of the WTP values implied by WTA/WTP with the estimated values. Of the 12 studies having income effects or income elasticities, 5 have more than one experiment with a WTA/WTP ratio. For those studies, we report the minimum, median, and maximum of the imputed elasticities. The value estimated for the study in the right hand column can be compared with the distribution of imputed values.

It is immediately clear that the elasticities reported by the studies or calculated from $\partial WTP/\partial y$ are an order of magnitude lower than the values implied by the WTA/WTP ratio. The lowest imputed value, 11.6, is roughly twenty-five times larger than the highest estimated value, 0.47.

The estimated coefficients are quite similar across studies. There is great variation in the imputed values across studies. Not only do the absolute imputed elasticities greatly exceed the estimated values, but the variation of the two sets of numbers across studies appears uncorrelated. The imputed income elasticities bear no resemblance to income elasticities estimated. While error-in-variable problems would probably bias the correlation toward zero, it seems implausible that the bias could be big enough to make the two sets of estimates the same order of magnitude.

In addition to the elasticities, Table 6 reports the income effects measured in several of the studies. They range from –6.68 to 0.0029. Consider the positive income effects in studies 8 and 18. For study 8, $\partial WTP/\partial Y = 0.0029$ and for study 18, $\partial WTP/\partial y = 0.00042$. These are the estimated regression coefficients. In study 8, there are eight experiments that provide WTA/WTP ratios. These ratios imply $\partial WTP/\partial y$ from 0.59 to 0.99. In study 18, there is one experiment whose WTA/WTP implies a $\partial WTP/\partial y$ of 0.80. For study 8, the implied slope is about 1900 times the estimated slope, while for study 18, the minimum implied slope is about 200 times the estimated slope.

5. Conclusion

The debate about the gap between WTP and WTA has previously been studied by searching for evidence of substitutability (the neoclassical hypothesis) or status quo bias, essentially testing for neoclassical versus psychological theories of preferences. In this paper, we study the gap differently. We ask whether there are any circumstances in which the observed pairs of WTA and WTP can be consistent with neoclassical preferences. We use a result from Sugden who showed that the effect of income on

willingness to pay can be approximated from information on the ratio WTA/WTP. We draw our inferences from a meta-analysis of 201 WTA/WTP ratios based on 45 separate studies.

We conclude that the ratio of WTA to WTP is too high to be consistent with neoclassical preferences. We base the conclusion on three types of findings. (1) The income slope implied by the WTA/WTP ratio is very high when judged against intuition. The mean income slope is approximately 0.8, implying that respondents would spend about 80 percent of extra income on an average experimental good. (2) The income elasticity of WTP that can be computed from the WTA/WTP ratios is very high when com-pared with elasticities found in the literature, which are estimated from regressions of WTP on income. The income elasticities imputed from the WTA/WTP ratios range from 80 for health and safety to about 3000 for lotteries. Elasticity estimates in the literature for environmental goods lie between zero and one. (3) The imputed income elasticities greatly exceed the elasticities estimated in the studies themselves. We find that the imputed elasticities exceed the estimated elasticities for the same studies by a factor of at least 75, and often by a factor of thousands.

The observed disparity can be taken in two ways. First, it can be interpreted a sign of weakness of survey methods such as contingent valuation. These methods do not measure preferences because respondents do not answer the questions consistently with neoclassical preferences (and we believe, based on other evidence, that subjects do have such "normal" preferences). A weak version of this interpretation is that willingness to pay questions measure preferences but willingness to accept questions do not. This

seems to be the interpretation given in the NOAA Blue Ribbon, which recommended that practitioners not use WTA questions.

Second, the disparity can be taken as evidence that subjects do not have neoclassical preferences, a conclusion which presumes that the experiments do capture "true" preferences in both WTP and WTA responses. The welfare consequences of subjects having non-neoclassical preferences, as this interpretation proposes, are unknown. It is not clear, for example, how constructs such as benefit-cost analysis should be altered.

We have focused on testable hypotheses from the neoclassical model and have shied away from alternative hypotheses based on any particular alternative model. Nevertheless, our results, with their emphasis on income effects, should help in honing in on explanations and alternative models, since they are such a prominent part of economic models, such as choice under uncertainty. We hope further research can establish these connections.

5. References

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Table 1. SUMMARY WTA/WTP STATISTICS (Weighted)[a]

	N	Mean	Standard Error
WTA/WTP	201	7.17	0.93
WTA/WTP (excludes estimated WTA/WTPs)	175	7.18	1.02
WTA/WTP (excludes Benzion, Rapaport, and Yagil)	169	7.86	1.07
Median WTA/ Median WTP	66	5.52	1.03
MEAN WTP ($1983)	169	$175	22.40

[a]Horowitz and McConnell, Table 2.

Table 2. WTA/WTP BY TYPE OF GOOD

	Mean WTA/WTP	Standard Error	Number of Experiments
Public or non-market goods	10.41	2.53	46
Health and safety	10.06	2.28	32
Ordinary private goods	2.92	0.30	59
Lotteries	2.10	0.20	25
All goods	7.17	0.93	201

Table 3. Implied Income Effects by Type of Good

	$\partial WTP/\partial y$
Public goods	0.904
Health and safety	0.900
Ordinary private goods	0.657
Lotteries	0.523
All goods	0.860

Table 4. WTP BY TYPE OF GOOD

	Mean WTP, 1983 PRICES	Standard Error	Number of Experiments
Public or non-market goods	$229.63	39.3	38
Health and safety	$235.02	64.8	20
Ordinary private goods	$5.56	1.07	59
Lotteries	$3.58	0.52	14
All goods	$175.07	22.4	169

Table 5. Implied Incomes Elasticities of WTP, by Type of Good

	$\eta = y/WTP \times \partial WTP/\partial Y$
Public goods	82.89
Health and safety	80.42
Ordinary private goods	2,540.60
Lotteries	3,141.80
All goods	122.86

Table 6. Estimated Relationships between WTP and Income

Study	Mean Income	Coefficient on dW/dy	Elasticity = d*ln*W/d*ln*Y
1. Adamowicz, Bhardwaj, and McNab, 1993	Not reported	Positive, insignificant; not reported (movie ticket) Insignificant; not reported (hockey ticket)	--
6. Bowker & MacDonald, 1993	$43,300 (WTP) $40,900 (WTA)	dWTP/dy: -0.90, -0.46; not sig. dWTA/dy: -6.78, -4.97; not sig.	--
8. Brookshire & Coursey, 1987	Not reported	dWTP/dy: 0.0029 dWTA/dy: -0.26; not sig.	WTP: 0.41 WTA: 0.55
9. Brookshire, Randall, and Stoll, 1980	≈$21,000	--	0.31, 0.37
17. Hammack & Brown, 1974	$12,000	--	0.40-0.48, depending on specification
18. Hoehn & Loomis, 1993	$40,890	dWTP/dy: 0.00042	≈0.104[a]
21. Horowitz, 1991	$8,000 (assets)	Positive, insignificant	
26. Kunreuther and Easterling, 1992	Not reported	Insignificant; coeff. not reported	
32. McDaniels, 1992	$30,000-$45,000	Coeff. not reported	
36. Rowe, d'Arge & Brookshire, 1980	$12,000	--	0.25-0.36
39. Sinclair, 1976, in Gordon and Knetsch	$12,000	--	WTP: 0.12 WTA: 0.45
43. Van Kooten & Schmitz, 1992	Not reported	--	≈0.26

Table 7. Implied versus Estimated Relationship between WTP and Income

Study	K[a]	Implied Elasticities			Elasticity Estimated from Coefficient on dWTP/dy or d*ln*(WTP)/d*ln*(y)
		Min	Median	Max	
1	3	302	335	2374	Positive, insignificant (movie ticket) Insignificant; coeff. not reported (hockey ticket)
6	1	--	343	--	Negative, insignificant
8	8	1182	1606	2440	0.41
9	3	175	241	555	0.37
17	1	--	37.1	--	0.47
18	1	--	1141	--	0.104
21	1	--	154	--	Positive, insignificant
26	2	22.3	--	94.9	Insignificant
32	1	--	87.7	--	Coefficient not reported
36	4	165	1851	3142	0.25 to 0.36
39	1	--	22.8	--	0.12
3	1	--	5082	--	0.26

[a]Number of experiments per study