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Source: *The Quarterly Journal of Economics*, Vol. 102, No. 3 (Aug., 1987), pp. 679-690

Published by: [The MIT Press](#)

Stable URL: <http://www.jstor.org/stable/1884223>

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THE DISPARITY BETWEEN WILLINGNESS TO ACCEPT AND WILLINGNESS TO PAY MEASURES OF VALUE*

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I. INTRODUCTION

Psychologists have long argued that people are much more averse to a loss than attracted to an equivalent gain. This behavior, termed loss aversion, has been formalized by Kahneman and Tversky [1979] in their reformulation of expected utility theory, prospect theory. In prospect theory the utility function is replaced by a value function that evaluates changes in income from the current level. Increases in income are weighted by a relatively small marginal utility. Decreases in income are weighted by a much larger marginal utility. In effect, the value function implies that a kink in the relationship between utility and income occurs at the initial income or reference point and that the slope of the utility function for losses in income is steeper than it is for gains.

In a recent paper Knetsch and Sinden [1984] report a series of experiments that demonstrate the existence of a large disparity between willingness to accept (WTA) and willingness to pay (WTP) measures of value. They argue that the psychological theory of loss aversion explains this difference. Economic theory would suggest that individuals who exhibit a large disparity between WTA and WTP are perhaps underperceiving the value of gains or overperceiving the value of losses, are behaving in an irrational manner, and will consequently achieve a lower level of well-being than if they behaved in a true utility-maximizing manner. This would, in contrast to loss aversion, usually imply near equal values for WTA and WTP (see Willig [1976]). Further documentation of a larger than expected disparity between WTA and WTP has been obtained in surveys asking for the value of a variety of public goods. For example, Cummings, Brookshire, and Schulze [1986] document six

*We would like to thank Alan Carlin and Ann Fisher as well as several anonymous reviewers for helpful comments on earlier drafts of this paper. Human subject payments made while conducting the experiments reported here were provided by the Bugas Fund at the University of Wyoming. Conceptual support was provided by the U. S. Environmental Protection Agency, Office of Policy, Planning and Evaluation, through a project entitled "Experimental Methods for Assessing Environmental Benefits." All remaining errors and conclusions are the sole responsibility of the authors.

cases in which survey values for commodities ranging from hunting permits to cleaner air show disparities from about three to one up to ten to one in the ratio of WTA to WTP. Given the serious challenge to economic theory presented by both the Knetsch and Sinden results and the survey research mentioned above, it is important to note that recent research in experimental economics suggests several modifications to the experimental design used by Knetsch and Sinden. This paper reports on an experiment that incorporates these modifications and that we believe considerably attenuates the disparity between WTA and WTP at least after individuals have accumulated market-like experience. However, for commodities such as public goods that are not traded in markets, loss aversion may still have serious implications for welfare economics.

The first concern with respect to the Knetsch and Sinden experiments is the use of lottery tickets as the "commodity" to be valued. Their objective is to determine whether an inexplicably large difference between willingness to accept and willingness to pay (sell) measures of value exists. The hypothesis they are implicitly testing is that changing the frame or context of the decision from a choice to sell to a choice to purchase will itself have a large impact on values. However, by introducing uncertainty into their experimental design, a second source of potentially irrational behavior may be introduced into the analysis. It has been demonstrated repeatedly in economic laboratory experiments that initial choices made under uncertainty do not conform to the predictions of the expected utility model (see, for example, Knez, Smith, and Williams [1985]). More specifically, Grether and Plott [1979] have documented the phenomenon of "preference reversal" for the case in which individuals face a choice between two lotteries. Preference reversal can be illustrated as follows: Lottery A has a high probability of a low monetary reward; Lottery B has a lower probability of a higher monetary reward. Grether and Plott demonstrate convincingly that the same individual will often choose Lottery A over Lottery B but assign a higher monetary value to B than to A. Preferences, as determined by the pattern of choice, are reversed when expressed in monetary terms. Ideally, a test of the existence of a disparity between WTA and WTP measures of value would, at least initially, be conducted under certainty.

The second concern with the Knetsch and Sinden experimental design is the failure to use an institution that allows for learning. None of the Knetsch and Sinden experiments utilize repeated learning trials for individuals to familiarize themselves with the

market institution employed. "One shot" experiments like the ones utilized by Knetsch and Sinden almost never produce behavior consistent with economic theory. A large body of the experimental economics literature has been focused on the comparison and development of *special* solicitation institutions (market-like mechanisms) that are *demand revealing* [Smith, 1977; Cox, Roberson, and Smith, 1982]. One such mechanism is the Vickrey or competitive auction [Vickrey, 1961, 1976]. It is such a mechanism that we employ (in contrast to the Knetsch-Sinden experiment) to obtain values for WTA and WTP that might be interpreted as mature market values.

The Vickrey auction is a modification of the traditional sealed bid auction, where incentives for demand (or supply) revelation are restored. In a Vickrey auction eliciting WTA, to use the example of sealed bids for a public construction project, the lowest bid wins, but the winner receives as payment for doing the work an amount equal to the second (or next to) lowest bid. If a Vickrey auction were used to elicit WTP at an art sale, all bids would be sealed, the highest bid would win, but the winner would pay an amount equal to the second highest bid. Since individuals in Vickrey auctions do not pay or receive what they bid, incentives for false (strategic bids) are not present. In experimental situations the Vickrey market institution performs well in revealing individual demand. However, an important observation to be drawn from experimental economics is that individuals participating in a Vickrey auction do not initially reveal "true" values. On a purely theoretical economic basis, they "should" realize that this is their dominant strategy. However, a number of trial iterations are required to allow individuals the opportunity to learn that revealing "true" values is their best strategy [Coppinger, Smith, and Titus, 1980; Cox, Roberson, and Smith, 1982].

The importance of learning and experience in laboratory markets cannot be overemphasized. Studies such as those reported in Knetsch and Sinden have concentrated on inconsistencies in *individual* responses to questions solicited *outside of market* situations. But, as noted by Knez, Smith, and Williams [1985], "If individuals modify their opinions and their decisions in light of this [market] experience, these effects will not be reflected in the instruments that have been used in 'framing' studies . . . Most (but not all) experimental markets show some learning effects over time with equilibrium behavior quite different from start-up behavior." We show below that although individual opening bids in a Vickrey

auction show a large disparity between WTA and WTP, consistent with the results of Knetsch and Sinden, ending bids submitted after a series of learning trials are similar. Thus, the market-like learning experience of the Vickrey auction causes the disparity reported by Knetsch and Sinden to be greatly reduced. One interpretation of this result is that as individuals evaluate the consequences of their decisions over a series of iterative trial auctions, they more fully learn both their "true" preferences and that full demand revelation is their dominant strategy. Since much economic activity takes place in organized markets, this result suggests that economic theory is most likely adequate to explain behavior as long as individuals have the opportunity to "learn to be rational" through market experience. In other words, economic theory is correct in predicting that WTA and WTP will usually be close in a mature market setting [Willig, 1976]. However, a large disparity may well persist outside of markets or where inexperienced market decisions are made.

II. EXPERIMENTAL DESIGN

The first difficulty in developing an experimental design to explore divergences between WTA and WTP is the choice of a commodity for sale and purchase by subjects. The commodity must be unfamiliar to the subjects to avoid preconceived notions of value that could bias the results and to allow a large potential disparity between WTA and WTP to exist. Experimental economists, under conditions of certainty, have traditionally used "induced values." The commodity in induced-value experiments can simply be a coupon that can be redeemed at the end of the experiment by the subject for its face value in cash. Thus, the value to the subject of the commodity is controlled by the experimenter. It is precisely this framework in which the strong demand-revealing nature of the Vickrey auction has been demonstrated. However, this controlled value framework does not plausibly allow for a divergence between WTA and WTP to exist for subjects. Thus, a commodity with an initially unknown value to the subjects must be used.

The commodity chosen for use in the experiment is a bitter-unpleasant taste experience. Psychologists have traditionally used sucrose octa-acetate (SOA) in taste experiments because it is the only known laboratory substance that is bitter and yet nontoxic. SOA is safe (breaking down into sugar and vinegar in the body) but very unpleasant [Green, 1941; Linegar, 1943]. In the WTA experi-

ments, subjects are offered payment to taste SOA. In the WTP experiments subjects offer to pay to avoid tasting SOA. Tasting involves the subject holding a one-ounce cup of a concentrated SOA solution in the mouth for 20 seconds. The SOA taste experience was carefully described both verbally by the experimenter and in the written instruction package each subject received at the start of the experiment.

Four groups of eight full-time students recruited from undergraduate business classes at the University of Wyoming participated in the WTA experiments, and four similar groups of eight students participated in the WTP experiments. No subject participated in more than one experiment. The first part (Part I) of each experiment consisted of asking each of eight subjects either how much hypothetically they must be paid to taste SOA (WTA experiments) or how much hypothetically they would pay to avoid testing SOA (WTP experiments). The bids produced in the first part of the experiment are termed purely hypothetical (H) bids because individuals had not yet tasted the SOA liquid.

The second part of the experiment (Part II) involved three steps. In the first step individuals tasted a few sample drops of the SOA solution. In the second step individuals were again asked for the WTA or WTP bids to taste a full one-ounce cup of SOA. We refer to these values as semi-hypothetical (SH) bids. In the third step the experimental monitor attempted to lower (raise) the WTA (WTP) bids in 25 cent increments. The process was initiated from the level of the individual's semi-hypothetical bid. As soon as an individual refused to further lower (raise) his bid, the monitor recorded the final bid as the individual's semi-hypothetical iterated (SHI) bid. All subjects were addressed on a one-to-one basis. This procedure was designed both to give individuals some limited experience with the commodity and to determine how closely hypothetical values might correspond to final auction values. The procedure for obtaining hypothetical values closely follows the survey mechanism proposed by Randall et al. [1974].

In the third part of the experiment (Part III) the eight individuals in a group participated in a Vickrey auction designed to elicit individual competitive bids. Four one-ounce cups of the SOA solution were auctioned to the group of eight individuals. For brevity only the structure of the WTP auction is described below. The WTA auction was conducted in a mirror-like manner.

Each individual in the WTP auction was given a \$10 credit to use in the auction (no credit was given in the WTA auction). During

each trial each individual first submitted his or her bid to avoid tasting one cup of the SOA solution. Bids were then collected by the monitor and rank ordered from highest to lowest. The fifth highest bid was then reported back to the eight subjects as the reigning price. The four individuals with bids higher than the reigning price were then able to determine that they had "won" the auction implying that they could pay the reigning price (not their own bid) to avoid tasting SOA. The losers paid nothing but had to taste the SOA solution if the trial was final. To determine whether the trial was final, unanimity was required among the winners. Only if no winner objected, was the trial considered final. Further, the first four trials were nonbinding in that even if no winner objected, another trial was conducted. Trials 5 and on could produce a potentially binding outcome. The experiment ended either with no objections among winners, in which case four individuals paid to avoid tasting SOA and four individuals had to taste the SOA; or in the case where an objection remained after ten trials, all parties had to taste the SOA solution. Both the unanimity requirement and the nonbinding practice trials have been shown to be helpful in promoting learning and, as a result, in revealing true values in induced value experiments [Smith, Williams, Bratton, and Vannoni, 1982; Smith, 1982; Coursey and Smith, 1984; Miller and Plott, 1983]. In particular, the unanimity requirement allows a "winner" who has made a mistake to reject the outcome and force another auction trial.

III. EXPERIMENTAL RESULTS

A summary of the results from the four willingness to accept and the four willingness to pay experiments is reported in Figure I. Each point plotted in the two diagrams represents an average bid of the eight subjects who participated in a single experiment. Plotted are Part I hypothetical bids, Part II semi-hypothetical bids and iterated semi-hypothetical bids, and Part III trial-by-trial outcomes. Figure II reports the same data found in Figure I, but averages are taken across all individuals in both sets of experiments. Part III average trial-by-trial outcomes are reported for the first four trials and, since different experiments concluded on different trials, for the ending trial.

A one-tailed rank-sum test utilizing average data obtained from the eight experiments was conducted at the 99 percent confidence level in order to compare willingness to accept and

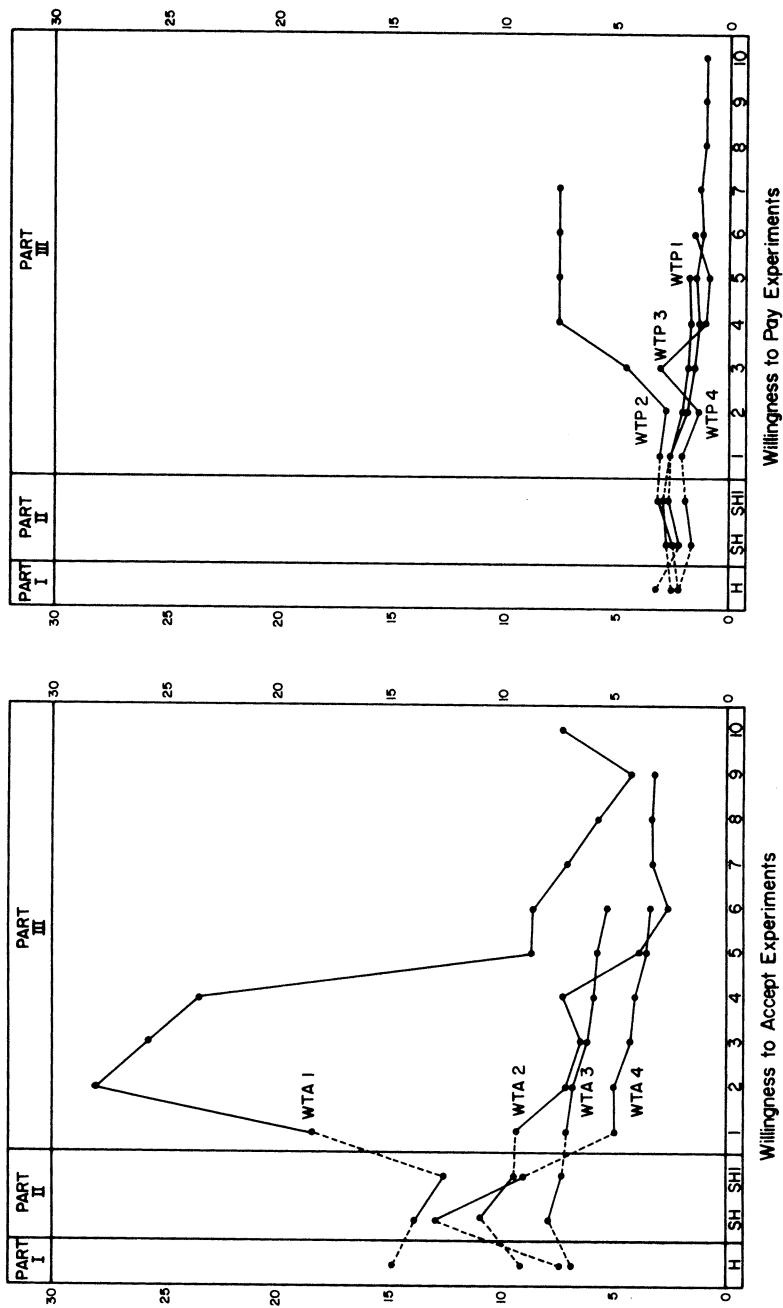


FIGURE I
Average Single Experiment Responses
Each point represents average of the eight individuals who participated in a single experiment.

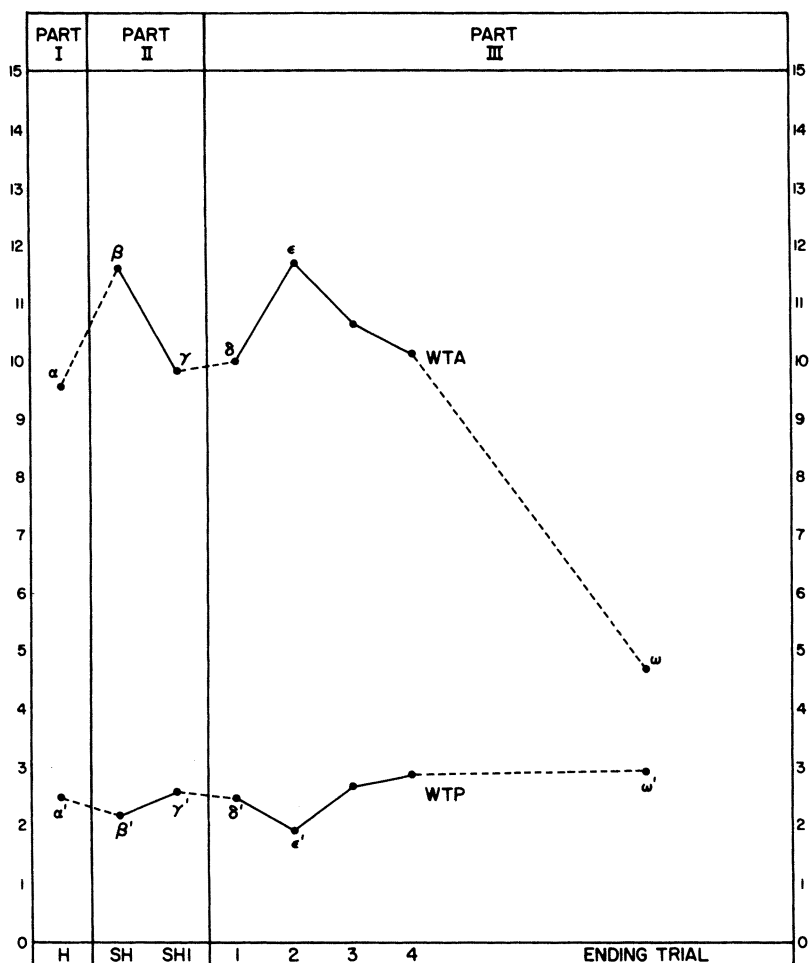


FIGURE II
Overall Average Experimental Responses

Each point represents overall average of the thirty-two individuals who participated in each of the WTA and WTP experiments.

willingness to pay measurements obtained in the three parts of our experiment. This test was used because bids obtained in the experiment are not normally distributed. Applying the rank sum test, we reject the hypothesis that willingness to accept and willingness to pay measurements obtained in Part I's totally hypothetical setting are equal. That is, points α and α' in Figure II are statisti-

cally different. This statistical difference extends to Part II's semi-hypothetical bids β and β' . After the iterative bidding process was conducted, willingness to accept (pay) bids decreased (increased) as expected ($\gamma < \beta, \gamma' > \beta'$), but final iterative bids γ and γ' remain statistically different. *Only after completion of the auction process* can we accept the hypothesis that willingness to accept and willingness to pay measurements ω and ω' are equivalent.

We also used the rank-sum test to consider whether there was a difference between methods used to collect willingness to accept and willingness to pay bids. We cannot reject the hypothesis that any of the three traditional survey methods used to obtain hypothetical values reported for Parts I and II yield different average willingness to accept or willingness to pay bids. That is, α , β , and γ are statistically equivalent, and α' , β' , and γ' are statistically equivalent. After the auction process was conducted, final willingness to accept bids did collapse to a lower value ω . However, a corresponding phenomenon did not occur in the willingness to pay experiments. A statistically significant rise in willingness to pay bids did not occur with the exception of the single experiment WTP2. Thus, competitive pressures do not appear to hold with an equal force in the willingness to accept (supply) and the willingness to pay (demand) auctions. The reported evidence strongly suggests that subjects do decrease their requested payments required to consume the SOA solution. This result does not extend unequivocally or symmetrically to the willingness to pay auction environment.

IV. SUMMARY AND CONCLUSIONS

First, note that as one moves from left to right across Figure II, WTA and WTP move in opposite directions through each and every phase of the experiment. The hypothetical WTA and WTP results (expressed as average values across individuals) are initially far apart (points α and α' , respectively). This result is consistent with the existing literature supporting a large disparity between WTA and WTP obtained in the field survey approach for valuing goods (see, for example, Hammack and Brown [1974]; Bishop and Heberlein [1979]; and Rowe et al. [1980]). It is, of course, this literature that motivated the Knetsch and Sinden experiments. Surprisingly, actual experience with the commodity (tasting SOA) drives hypothetical WTA and WTP farther apart (points β and β').

Iterative bidding causes WTA and WTP to converge (points γ

and γ'). Obviously, this suggests that the iterative procedure may be of some use in obtaining hypothetical values. As the Vickrey auction begins (points δ and δ'), opening bids for WTA and WTP are similar to, but further apart than, the iterated hypothetical bids. In the second auction trial (ϵ and ϵ') WTA and WTP diverge. This may be the result of some individuals in the experiment attempting to employ dynamic trial strategy not addressed in the static Vickrey models. Another explanation for this early divergence may, as Knetsch and Sinden suggest, be cognitive dissonance. Individuals may on the WTA side be engaged in "wishful thinking" as to how much they "ought" to be paid to taste a bitter substance. In any case, in early trials individuals may not initially understand that the best strategy is to reveal "true" values, but ultimately WTA and WTP converge strongly (points ω and ω'). This convergence is, however, strongly asymmetrical in that the WTA measure of value "collapses" downward under the competitive market-like experience of the auction, while WTP trial values show only a modest and statistically insignificant upward movement. This suggests that if cognitive dissonance is at work, it does not largely apply on the WTP side but rather may be induced by the prospect of receiving money on the WTA side.

Final auction measures of WTA (point ω) and WTP (point ω') are statistically similar. However, although hypothetical WTA (say, that from point γ) is not statistically similar to WTA obtained in the auction (point ω), hypothetical willingness to pay (say, point γ') is statistically similar to WTP obtained from the auction (point ω').

These results suggest three conclusions. First, hypothetical measures of value obtained using WTA are likely to be biased upwards from values obtained from a market-like auction. Psychological factors may well explain this bias.

Second, hypothetical measures of value obtained using WTP may correspond more closely than hypothetical WTA measures to market values. Psychological factors do not appear to influence hypothetical WTP to the degree present for WTA. Framing effects may thus be reduced by use of hypothetical WTP measures of value.

Third, given the demand-revealing nature of and learning experiences in the Vickrey auction, values for WTA and WTP tend to converge in a mature market setting. This result is consistent with economic theory and suggests that the divergence obtained in early trials of the experiment for WTA and WTP may result mainly

from lack of a market experience. To wit, if the initial divergence in WTA and WTP measures is due to cognitive dissonance as some psychologists suggest, individuals may well learn to become more rational under the pressure of a competitive market. However, as Knetsch and Sinden have demonstrated, psychological arguments may be of great value in explaining behavior that occurs with limited market experience.

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REFERENCES

- Bishop, R. C., and T. A. Heberlein, "Measuring Values of Extra-Market Goods: Are Indirect Measures Biased?" *American Journal of Agricultural Economics*, VI (December 1979), 916-30.
- Coppinger, V. M., V. L. Smith, and J. A. Titus, "Incentives and Behavior in English, Dutch and Sealed-Bid Auctions," *Economic Inquiry*, XVIII (January 1980), 1-22.
- Coursey, D. L., and V. L. Smith, "Experimental Tests of an Allocation Mechanism for Private, Public or Externality Goods," *Scandinavian Journal of Economics*, LXXXVI (1984), 468-84.
- Cox, J. L., B. Roberson, and V. L. Smith, "Theory and Behavior of Single Price Auctions," V. L. Smith, ed., *Research in Experimental Economics*, II (Greenwich, CT: JAI Press, 1982).
- Cummings, R. G., D. S. Brookshire, and W. D. Schulze, eds., *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method* (Totowa, NJ: Rowman & Allanheld, 1986).
- Green, M. W. "Sucrose Octa-Acetate as a Possible Bitter Stomachic," *Bulletin of the National Formulary Committee of the American Pharmaceutical Association*, X (1941), 131-33.
- Grether, D. M., and C. R. Plott, "Economic Theory of Choice and the Preference Reversal Phenomenon," *American Economic Review*, LXIX (1979), 623-38.
- Hammack and Brown, *Waterfowl and Wetlands: Toward Bioeconomic Analysis* (Baltimore, MD: The Johns Hopkins University Press, 1974).
- Kahneman, D., and A. Tversky, "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica*, XLVII. (March 1979), 263-91.
- Knetsch, J. L., and J. A. Sinden, "Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value," *this Journal*, XCIX (August 1984), 507-21.
- Knez, P., V. L. Smith, and A. Williams, "Individual Rationality, Market Rationality, and Value Estimation," *American Economic Review*, LXXV (March 1985), 397-402.
- Linegar, C. R., "Acute and Chronic Studies on Sucrose Octa-Acetate by the Oral Method," *Bulletin of the National Formulary Committee of the American Pharmaceutical Association*, XI (1943), 59-63.
- Miller, G., and C. Plott, "Revenue Generating Properties of Sealed-Bid Auctions," in V. L. Smith, ed., *Research in Experimental Economics*, III, (Greenwich, CT: JAI Press, 1983).
- Randall, A., B. Ives, and C. Eastman, "Bidding Games for Valuation of Aesthetic Environmental Improvements," *Journal of Environmental Economics and Management*, I (1974), 132-49.
- Rowe, R., R. d'Arge, and D. Brookshire, "An Experiment on the Economic Value of Visibility," *Journal of Environmental Economics and Management*, VII (1980), 1-19.
- Smith, V. L. "The Principal of Unanimity and Voluntary Consent in Social Choice," *Journal of Political Economy*, LXXXV (1977), 1125-39.
- , A. W. Williams, W. K. Bratton, and M. G. Vannoni, "Competitive Market Institutions: Double Auctions vs. Sealed Bid-Offer Auctions," *American Economic Review*, LXXII (March-May, 1982), 58-77.

- Vickrey, W., "Counterspeculation, Auctions and Competitive Sealed Tenders," *Journal of Finance*, XVI (March 1961), 8-37.
- , "Auctions, Markets, and Optimal Allocation," in Y. Amihud, *Bidding and Auctioning for Procurement and Allocation* (New York, NY: University Press, 1976).
- Willig, R. D. "Consumers' Surplus without Apology," *American Economic Review*, LXVI (September 1976). 589-97.