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A Challenge to Three Widely Held Ideas in Environmental Valuation

Matthew G. Interis

Environmental valuation is the branch of environmental economics in which researchers estimate the economic value of environmental goods and services. Environmental valuation has been practiced for decades. However, there are some ideas in the field of environmental valuation held by many environmental economists and nonenvironmental economists that appear to be outdated. This article discusses three such ideas: 1) that it is better to estimate willingness-to-pay values than willingness-to-accept values; 2) that stated preference valuation methods are questionable because they are based on hypothetical choices rather than real choices; and 3) that it is better to use a repeated-choice question format than a single-choice format in choice experiments. We discuss the origins of each idea and why the idea became prevalent in the first place. We then review recent literature, which casts doubt on the idea. We conclude with a reminder for researchers—in environmental economics and in other economic fields—to periodically reassess ideas they currently hold in light of recent research developments and in light of the context in which they are used.

Key Words: environmental valuation, choice experiments, stated preference methods, willingness to accept, willingness to pay

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Periodically, as professionals looking to improve our (social) science, we need to reexamine long-held beliefs. This article is a call for all economists, but especially environmental economists specialized in valuation, to do just that. Economists have practiced environmental valuation for over 60 years (Adamowicz, 2004), and one would hope that the science of valuation has improved over that time. The working hypothesis of this article is that there have been significant advancements in research on the valuation topics discussed here, of which many economists, but not excluding environmental valuation economists, may not be aware. To a certain extent, researchers cannot be blamed for persisting in believing outdated ideas if those ideas are on the periphery of their research interests and there has not been any particular reason to re-examine those ideas. On the other hand, it is good for our science (that is, the whole science of economics) to periodically step back from the minutiae of our particular research interests and learn what else is going on in the field. If we can bring each other up to speed on our respective areas of expertise, there will be less effort spent debating ideas of the past and more time for research on the frontier. Conferences and seminars will always be outlets for the debating of ideas, and of course one can never be an expert in every research area within economics, but the topics discussed in this article are three for which research progress and is inhibited as a result of outdated ideas.

Matthew G. Interis is an assistant professor at the Department of Agricultural Economics, Mississippi State University, Mississippi State, Mississippi.

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The three ideas are: 1) that it is better to estimate willingness-to-pay values than willingness-to-accept values; 2) that stated preference valuation methods are inferior to revealed preference methods because the former are based on hypothetical rather than real choices; and 3) that it is better to use a repeated-choice question format rather than a single-choice format in choice experiments. Each of these is not always true in all contexts. Of course, these ideas can never be judged to be true or false in a purely objective manner unless the definitions of "better" and "inferior" are agreed on and can be perfectly assessed, a practical impossibility. Rather, an idea is defined as "false" if there is not only some but an abundance of evidence to the contrary. Evidence may take the form of scholarly opinion and theory in peer-reviewed journals, logical argument, or empirical evidence.

The first two ideas have been debated for years but are now looked on with a new perspective in light of recent research. The third idea, although admittedly of less general interest than the other two, seems widespread only because early choice experiment researchers favored the repeated-choice format, probably because the advantages of increased information elicitation were obvious, but the disadvantages (and recent research has shown there are many) were less obvious.

The topics discussed in this article will certainly be of varying interest and of varying relevance to different researchers in economics. However, all readers should take away the central reminder of this article: to periodically reassess ideas they currently hold in light of recent research developments and in light of the context in which these ideas are used.

Willingness-to-Pay Estimates versus Willingness to Accept

Willig (1976) showed that, unless there are large income effects, willingness to pay and willingness to accept should be quite close to each other. However, environmental valuation studies have found rather large gaps between the two for quite some time in stated preference surveys (e.g. studies cited in Cummings, Brookshire, and Schultze, 1986), laboratory experiments (e.g., Kachelmeier and Shehata, 1992; Kahneman, Knetsch, and Thaler, 1990), and natural experiments (e.g., Putler, 1992). Indeed, Hanemann (1991) showed that the disparity between willingness to pay and willingness to accept can be quite large if there are few substitutes for the good in question. Environmental goods often have fewer substitutes than market goods, so a larger gap would generally be expected in environmental valuation.[1] Furthermore, the psychological theory of loss aversion (see Kahneman and Tversky, 1979) posits that people are generally more averse to losses than they are attracted to equivalent gains. As Knetsch (2010) points out, researchers have been so preoccupied with trying to explain away the disparity between the two value measures that they have failed to take the abundance of evidence seriously as indicating that people value losses more than they value equivalent gains. All this is to persuade the reader that willingness to pay and willingness to accept are not always "close" to each other and that the choice of which value to measure is not always trivial.

That said, conventional wisdom is that it is better to estimate willingness to pay than willingness to accept. Where did this idea come from? It is difficult to pinpoint exactly, but certainly an influential source of this idea was the Report of the National Oceanic and Atmospheric Administration (NOAA) Panel on Contingent Valuation (Arrow et al., 1993), which throughout recommends estimating willingness to pay rather than willingness to accept. From page four of the report:

> Nevertheless, because of the concern that respondents would give unrealistically high answers to such questions, virtually all previous [contingent valuation] studies have described scenarios in which respondents are asked to pay. . .This is the conservative choice because willingness to accept compensation should exceed willingness to pay. . .

[1] This substitution effect on the size of the discrepancy between willingness to pay and willingness to accept applies to quantity-rationed (as opposed to price-rationed) goods (Hanemann, 1991).

This excerpt highlights two main arguments for estimating willingness to pay rather than willingness to accept that have haunted valuation for decades. The first is that willingness to pay is the more "conservative" measure of value. The proper meaning of "conservative" is best expressed by Mitchell (2002) as "the direction that is opposite to the survey sponsor's apparent interests" (p. 302). By making choices that lead to conservative value estimates, the researcher protects him- or herself against the potential criticism of biasing his estimates. However, throughout the NOAA Report, "conservative" is used synonymously with "smaller." The reason for this is that, at the time of the Report, contingent valuation was being used in a high-profile legal case brought against Exxon for damage compensation resulting from the Exxon-Valdez oil spill in Prince William Sound, Alaska, in 1989. The state of Alaska hired contingent valuation economists to estimate the value of the damages from the spill in support of its claims. The meeting of the NOAA Panel was requested as a direct result of this legal case in which it is clear that the survey sponsor benefits from higher damage estimates. Unfortunately, however, the Report gives the impression that "conservative" always means "smaller" and therefore that "smaller" is always better. Because willingness to accept exceeds willingness to pay, the implication is therefore that willingness-to-pay estimates are preferable. However, in many if not most valuation studies, there is no clear direction of the survey sponsor's interests. Few contingent valuation studies are executed in the context of damage compensation sought in a legal case. Therefore, the concept of "conservative" is meaningless, and this argument for estimating willingness to pay rather than willingness to accept is inapplicable.

The second argument for estimating willingness to pay rather than willingness to accept that is emphasized in the NOAA Report is that "respondents would give unrealistically high answers to [willingness to accept] questions," hinting at the conception that willingness-to-pay valuation questions in stated preference surveys[2] had been thought to be more incentive-compatible than their willingness-to-accept counterparts. In particular, if you ask someone how much he or she is willing to accept as compensation for something, there is no upper bound, whereas we generally expect that willingness to pay is bound by one's income. Although it has always been considered more difficult to design an incentive-compatible willingness-to-accept valuation survey than a willingness-to-pay survey, there have (just as with willingness-to-pay surveys) been promising advancements in willingness-to-accept survey design. For example, Bush et al. (2013) implement a willingness-to-accept survey with a provision point mechanism whereby no one receives compensation for damages if total claims exceed a threshold. They find that this scenario format reduces willingness-to-accept estimates in a way consistent with theory and that demand revelation improves. Chilton et al. (2011) find that educating respondents on the definition of willingness to accept and the dangers of over- or underbidding through discussion and an experiment before giving respondents the survey leads to value estimates that are more theoretically consistent. However, despite some advancements in increasing the incentive compatibility of willingness-to-accept surveys, they still pose a challenge in terms of rejection of hypothetical market scenarios in which respondents receive compensation (Bush et al., 2013). It is important that respondents find the possibility of receiving compensation to be believable. On the other hand, it is also possible that respondents may reject a willingness-to-pay study, particularly when the implied property rights lie with the respondent. For example, Petrolia and Kim (2011) argue that, in their study of the value of preventing future coastal

[2] Our discussion of the merits of willingness to pay and willingness to accept is given mainly in the context of stated preference valuation. At the time of the NOAA Report, however, the number of published valuation studies using contingent valuation (a stated preference valuation method) was booming and was much higher than any other environmental valuation method (Adamowicz, 2004).

land loss in Louisiana, it is unclear whether implied property rights lie with the respondent. They elicit both willingness to pay and willingness to accept, arguing that "if the property right resides with the respondent, then it is inappropriate to ask the respondent about [willingness to pay] for a good for which he already claims ownership. . .Rather, one should ask for willingness to accept compensation to relinquish the right to the good" (p. 860).

The reader should take away from this discussion that there is no blanket conclusion that estimating willingness to pay is "better" than estimating willingness to accept. A number of considerations must be weighed including protecting oneself against possible accusations of biases in favor of the study sponsor, the theoretically correct measure of value, the likely size of the discrepancy between willingness to pay and willingness to accept, and whether a study with reasonable[3] incentives can be designed. When preparing research reports and journal manuscripts, the researcher should justify his choice of value measure and not simply measure willingness to pay by default. Willingness-to-pay studies have been far less common than willingness-to-accept studies. Moving forward, this may continue to be the case, but if so, we do not want it to be the case because of an unchallenged notion that willingness-to-pay estimates are "better." This kind of bias would delay advancements in research of willingness-to-accept elicitation methods.

Revealed Preference Methods versus Stated Preference Valuation

In stated preference valuation studies such as contingent valuation or choice experiment surveys, respondents answer choice questions that are hypothetical in the sense that respondents will not have to make a payment (or receive a payment for willingness-to-accept studies) as a direct result of their responses. Hypothetical bias arises when respondents do not make the same choices they would if they indeed had to face the specified consequences of their choices. There have been an abundance of studies examining hypothetical bias in stated preference surveys (e.g., Champ and Bishop, 2001; List and Gallet, 2001; Lusk and Schroeder, 2004) and some meta-analyses have found that value estimates based on hypothetical responses are on average approximately three times higher than those based on binding responses (List and Gallet, 2001; Little and Berrens, 2004).

However, two papers by Richard Carson and Theodore Groves in 2007 and 2011 have changed the way researchers of stated preference valuation methods think about hypothetical bias. The crux of their argument is that, as it is often used, the word "hypothetical" implies that the value elicitation questions or the survey in its entirety have no bearing on anything. Carson and Groves argue that we should not expect responses to these types of hypothetical questions to be the same as those from binding questions. On the other hand, neither should we expect them to be different. For to make predictions based on economic theory, there must be some consequence of the responses. Otherwise, any response to the valuation question yields the same expected utility, and expected utility maximization is the foundation for survey respondent choice theory.

The more appropriate definition of "hypothetical" is something along the lines of "contingent" (Carson and Groves, 2011) on actually being in the choice situation framed in the survey. From this alone we can say nothing about whether expected utility theory applies, which is why Carson and Groves emphasize the concept of consequentiality rather than the concept of hypothetical. If a question is consequential, one's response will (at least probabilistically) affects something. If the respondent also cares about what his response will affect, then expected utility theory applies and researchers can make predictions about respondent behavior. Usually, there is a lot of researcher effort that goes into designing stated preference surveys and the studies are often

[3] I use the word "reasonable" because, even for willingness-to-pay studies, it is well known that only a binary-choice question with coercive payment can be made incentive-compatible (Carson and Groves, 2007).

funded by entities actually interested in obtaining value estimates. It is hard to imagine that the survey results would not be shared with the study funder and other entities that have some interest in the policies described in the survey and who hold some authority in whether they are actually implemented. Why would anyone invest time and money into implementing an inconsequential survey?

Given that a survey is consequential, researchers then have to think critically about the incentives faced by respondents. Carson and Groves (2007) show that, for a single issue where the probability of implementation increases in the number of survey respondents favoring the project, the incentives are exactly the same as for an actual binding referendum, provided that payment for implementation of the project is compulsory. If the question format differs from a single binary choice, incentive compatibility is lost; however, the incentives are not necessarily different from those of a binding choice. The incentive structure of each study must be considered individually.

Recent studies have attempted to control for the consequentiality of the survey. Herriges et al. (2010) directly elicit respondent perceptions of whether they think the survey results will influence future policy and the study also contains a treatment in which respondents read a letter from an authoritative policymaker stating how such research helps his or her organization to make decisions. Petrolia, Interis, and Hwang (2014) also elicit respondent perceptions of the survey results' influence on policy. Both of these studies find higher value estimates for respondents who believe the survey to be consequential than for those who do not. If "hypothetical" is used in the sense of having no bearing, then this evidence is contrary to the common belief that "hypothetical" responses tend to be higher than "real" responses.

Very few studies comparing hypothetical and real responses have carefully controlled for incentives across the two treatments. Johnston (2006) finds no evidence of hypothetical bias in a study of the value of public water access across a binding public referendum and a consequential stated preference survey administered before public knowledge of the forthcoming referendum. Vossler, Doyon, and Rondeau (2012) compare responses with choice questions across treatments in a laboratory experiment, some of which (probabilistically) involve real payments and one which is purely hypothetical. Although the hypothetical treatment was not consequential in actuality, participants who believed the hypothetical choices to have more than a weak chance of influencing policy behaved indistinguishably from participants in the real payment treatments. Vossler and Watson (2013) compare hypothetical survey responses with actual votes of a parallel public referendum on conservation and preservation efforts in Massachusetts. They find that, after controlling for respondents who believe that the survey will potentially influence actual policy, differences in the proportion of "yes" votes and in willingness-to-pay values between the results of the survey and the actual referendum are minimal. As Haab et al. (2013) point out, more studies that compare hypothetical and real choices, but which also carefully control for incentives, are needed.

It is rare that researchers in environmental valuation can actually compare hypothetical and real choices in a setting other than a controlled laboratory experiment because most objects of valuation are public goods, many of which do not yet exist or for which there are no corresponding "real" choices to observe. An alternative measure of the external validity of stated preference value measures is to compare them with corresponding value measures from revealed preference studies. Stated preference approaches to valuation use choices, which indirectly reveal people's preferences for environmental goods and services to determine value estimates. The two most major revealed preference valuation methods are the travel cost method and hedonic pricing analysis. In the travel cost method, the researcher analyzes tradeoffs people make between visiting a (generally) recreational site and the cost of visiting a site. For example, the researcher might assume an individual chooses to visit a particular beach from a set of possible beaches he might visit. By examining the site characteristics of

each beach and the cost (that is, the full opportunity cost) the individual would incur visiting each candidate site, the researcher can estimate how willing the individual is to incur costs to go to a site with particular characteristics.[4] The hedonic pricing method uses the assumption that preferences for environmental amenities are captured in (usually) housing prices. By controlling for other housing characteristics, the research attempts to isolate the portion of the housing price that accounts for the value of environmental amenities.[5]

In a comprehensive meta-analysis of comparisons of value estimates between revealed and stated preference value estimates, Carson et al. (1996) find that stated preference value estimates are not statistically different from or are perhaps slightly lower than revealed preference estimates. In a more recent summary of meta-analyses of revealed and stated preference estimate comparisons, Londoño and Johnston (2012) cite a handful of studies that find no statistical difference between revealed and stated preference estimates, another handful that find revealed preference estimates to be higher, and yet another handful that find stated preference estimates to be higher. In sum, there seems to be no preponderance of evidence that, in particular, hypothetical choices yield higher value estimates than real choices that reveal preferences.

Now that stated preference research has been shifting toward a more careful consideration of incentives, and given the lack of evidence that stated preference methods perform less well than revealed preference methods, we certainly should not shy away from using stated preference methods when they are the only viable option. For example, when one wishes to estimate the value of goods or services that do not yet exist, one has little choice but to create those goods and services in a hypothetical market situation in a stated preference survey. Another possibility might be to transfer benefits from other studies on similar goods and services, but for certain goods and services, there may not be many viable comparison studies. Also, although benefit transfer has seen somewhat of a Renaissance in recent years, with renewed interest and advancements in methodology (e.g., Bateman et al., 2011; Kaul et al., 2013), lack of proper reporting of primary research can pose a challenge for benefit transfer (Loomis and Rosenberger 2006).[6] The other main case in which one has little choice but to use stated preference methods is when one wishes to estimate nonuse value, because it is the only known approach to doing so.

Practically, the decision of whether to use revealed or stated preference data depends on which kind of data are most readily obtainable subject to the constraint that the data can actually be used to estimate the desired welfare measures. For example, original stated preference studies can be quite costly (including both the direct cost of design and implementation and opportunity costs for designing the study). If the environmental amenity to be valued is likely captured in the variation in housing prices, it may be less costly to obtain data on existing market transactions to complete the analysis. However, one frontier of environmental valuation research centers on the combining of revealed and stated preference data sources. The revealed preference data serve to temper any concerns one may have about relying only on stated preference data. The stated preference data are combined with the revealed preference data to increase the number of observations or to complement it, for example, to capture nonuse value.[7]

Single- versus Repeated-Choice Question Formats in Choice Experiments

Choice experiments are a specific class of stated preference surveys in which respondents

[4] I have just described the site choice travel cost model. There is also a model for a single site. For a broader overview on the travel cost method, see Ward and Beal (2000).

[5] For an introduction to the hedonic pricing method, see Taylor (2003).

[6] I do not mean to imply here that we should abandon benefit transfer research, just that it is not always a viable alternative. Johnston and Rosenberger (2010) offer several suggestions for future research in benefit transfer.

[7] For more on combining revealed and stated preference data, see Whitehead, Haab, and Huang (2011).

choose their most preferred from a set of mutually exclusive alternatives. Although Carson and Louviere (2011) consider contingent valuation, in which respondents make a choice between only two alternatives, to be a specific type of discrete-choice experiment, most researchers on hearing the phrase "choice experiment" tend to think of a choice or several choices among three or more alternatives, as in Adamowicz et al. (1998). Adamowicz et al. (1998) is considered a seminal paper in the use of choice experiments for environmental valuation, and since then, there has been an abundance of choice experiment environmental valuation studies. The issue of relevance to this section is that by far the majority of choice experiment valuation studies (by the more popular definition of containing choices among three or more alternatives) use a repeated-choice format where respondents are asked to choose their most preferred of several alternatives more than once (e.g., Alemu et al., 2013; de-Magistris, Gracia, and Nayga, 2013; Lanz and Provins, 2013).

A newsletter essay Dan Petrolia and I (2013) wrote for the Association of Environmental and Natural Resource Economists goes into much more detail on this issue of repeated choices, but one of our conclusions is that researchers are far from confident about interpreting repeated choice responses (regardless of whether respondents choose between two or more than two alternatives). For example, Holmes and Boyle (2005) find that responses to the fourth choice question are "more informative" than responses to previous choice questions, as judged by model fit and the number of significant parameters. On the other hand, Day et al. (2012) find that the first choice task in a repeated-choice survey has "excellent properties" including price and scope sensitivity and less status quo bias than subsequent choice questions. Also, respondents are more likely to make their choice to the first choice question based solely on attributes of the alternatives (as opposed to say, strategic choosing). Although one advantage of repeated choices touted by some authors is that respondents become more familiar with the idea of the choice task (Day et al., 2012; Holmes and Boyle, 2005), there is also the potential disadvantage that respondents learn to think strategically as they progress through the choice tasks (Scheufele and Bennett, 2012). These studies all point to the need for further research to fully understand strategic and behavioral motivations behind responses to repeated-choice surveys.

These issues about the validity of repeated choices are certainly worthy of further investigation, but it is surprising that, as researchers have tried to pry more information out of respondents, they have jumped quickly from the relatively sparse amount of information elicited from a single two-choice question format (i.e., contingent valuation) to the relative abundance of information from a repeated multiple-choice question format despite the dubious reliability of information from the latter. Environmental valuation researchers may have inadvertently overlooked a step in between: the single multiple-choice question format. Despite being the norm in revealed preference methods (Carson and Louviere, 2011), it has seen little use in stated preference methods. List, Sinha, and Taylor (2006) use the single three-choice question format in eliciting hypothetical contributions to fund a computer for the Center for Environmental Policy Analysis in central Florida. Newell and Swallow (2013) use a real-payment single-question format to value wetland conservation. Petrolia, Interis, and Hwang (2014) use the same question format in a study estimating the value of restoring coastal wetlands in Louisiana. This is the whole of studies using a single multiple-choice question format in fielded stated preference valuation surveys.

Admittedly, my claim that many choice experiment researchers think it is better to use a repeated-choice format is justified only by the abundance of repeated-choice studies and the dearth of single-choice studies. However, in light of other research on stated preference methods, on consequentiality and on incentive structure in particular, I would be interested in research that first examines the feasibility of a single-choice question with more than two alternatives. Much of this research could be along the same lines as early contingent valuation research: Does it matter if the good is

public or private? Is there sensitivity to scope? Are there ways to improve the reliability of responses? One of the major differences between a single two-choice question and a single multiple-choice question about a public good is that the latter cannot be made incentive-compatible. Although the multiple-choice question is not incentive-compatible, respondents may yet reveal their true preference. Do they? What sorts of factors (e.g., type of good, payment mechanism) affect whether respondents choose their unconditional favorite alternative even when they might have an incentive not to? Just as there are many interesting research questions about the repeated-choice format, there also remain many relating to the single-choice format. One cannot necessarily examine these issues in a repeated-choice survey, say, by ignoring responses subsequent to the first. As Day et al. (2012) point out, knowledge about the existence of future choice questions may affect responses to current choice questions.

Concluding Comments

There are research areas where the bulk of empirical evidence supports one view over another. I have argued that the three areas discussed in this article are not such areas of environmental valuation research. Until there is a consensus, it is important that we do not stifle potentially enlightening research because of predispositions we may have. Of course, it falls to the researcher to be sure that there is indeed an open avenue for research on a particular issue and furthermore, there is the consideration of whether the research is on a fresh or banal topic. The fact of the matter is that innovation is highly valued in economics, so it can be challenging to find success researching questions that have been examined extensively, even if they have not been adequately answered.

Nonetheless, it can be fruitful to periodically re-examine ideas we have taken for granted in the past and to acquaint ourselves with research progress in fields outside our own. We often have to attend conferences, have guest seminar speakers, and interview job candidates, and we owe it to each other to be open-minded to the possibility that, once we step outside our own areas of expertise, we may not be aware of new research insights.

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