



Methodological and Ideological Options

Plausible responsiveness to scope in contingent valuation

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ABSTRACT

Plausible responsiveness to scope is a question of economic significance, in addition to statistical significance, of the scope test in contingent valuation. We briefly review the history of the scope test in order to place the current issue in the context of the BP Deepwater Horizon oil spill. As a result of the review we gain insights into how the issue of scope “adequacy” arose twenty years after it was first mentioned by the NOAA Panel on Contingent Valuation following the Exxon Valdez oil spill. We then provide a review of Desvousges, Mathews and Train (2012) who promote the adding-up test to identify inadequate responsiveness to scope adequacy. The adding-up test is a test of the construct validity of the contingent valuation method but is flawed as a measure of economic significance. We propose scope elasticity of willingness-to-pay as a measure of economic significance. A simulation suggests a likely range of elasticity estimates given linear and quadratic functional forms for the willingness-to-pay function. In order to illustrate the ease of implementation of scope elasticity within the context of the standard scope test we calculate scope elasticity with willingness-to-pay estimates from several studies, describe two studies that directly estimate scope elasticity and estimate scope elasticity with primary data from two studies. All of these empirical estimates of scope elasticity fall within the range of scope elasticity suggested by the simulation. Scope elasticity provides a practical way forward, relative to the adding up test, on the issue of economic significance of scope effects.

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1. Introduction

Stated preference surveys that use the contingent valuation method (CVM) elicit willingness-to-pay under various scenarios. One scenario is to vary the scope of environmental quality or natural resource allocation. The scope test is important in contingent valuation for two important reasons. Most practically, in theory but not often in practice, it can be used to estimate the total benefit curve. Smith (1984) makes the point that benefit–cost analysis in practice rarely identifies the policy level for net benefit maximization. Similarly, the CVM can be used to estimate benefits for a single policy level and these can be compared to costs. But implementation of the scope test can be used to determine the most efficient level of policy. Given a total cost curve, the total benefit (i.e., willingness-to-pay) curve could be used to estimate the optimal level of environmental quality or natural resource allocation instead of identifying levels that are more or less efficient than the status quo (e.g., Lindhjem et al., 2015).

The scope test is also an important construct validity test. Willingness-to-pay should be non-decreasing in the scope of environment quality or quantity of the natural resource allocation. Responsiveness to scope indicates that stated preferences conform to economic theory and lends validity to the CVM. On the other hand, failure of the scope test does not invalidate the CVM. The scope test is not a “crucial

experiment” (Randall, 1998) and failure could be due to diminishing marginal utility, substitution, behavioral anomalies, a poorly designed and/or executed survey or small sample sizes that reduce the power of the test. Any study should be assessed with a variety of validity and reliability tests (Whitehead and Haab, 2013).

The NOAA Panel on Contingent Valuation (Arrow et al., 1993) stated that demonstration of “adequate” scope effects should be required for reliable measurement of willingness-to-pay for natural resource damage assessment. Desvousges et al. (2012) consider the adding-up test to be an adequacy test. The purpose of this paper is to reframe the issue of scope sensitivity as one of economic significance and propose scope elasticity as an alternative to the adding up test. We first briefly review the history of the scope test in the context of the Exxon Valdez and BP Deepwater Horizon oil spills. We next consider the adding-up test and provide a critique of Desvousges et al. (2012). We derive scope elasticity for two functional forms and conduct a Monte Carlo simulation to suggest a likely range. We provide a number of empirical examples to show the ease of implementation and understanding of scope elasticity.

2. A Brief History of the Scope Test

Mitchell and Carson (1989) first described the scope test as “part-whole bias.” While scope tests had been performed prior to Mitchell and Carson, the controversy surrounding scope may have begun with the Kahneman (1986) and Kahneman and Knetsch (1992)

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“embedding” study. Kahneman and Knetsch (1992) find that willingness-to-pay is no different when a good is valued by itself and when it is valued as part of a larger bundle. Smith (1992) criticizes the survey and study design of Kahneman and Knetsch (1992) which fell short of best practice of the CVM.

Following the 1989 Exxon Valdez oil spill the state of Alaska commissioned a study to estimate the lost passive use values due to the spill with the intention to seek damages from Exxon. Carson et al. (1992, 2003) conduct a number of validity and reliability tests but do not conduct a scope test. In response, a team of researchers was assembled with funding from Exxon to critically evaluate the CVM and two volumes denouncing the contingent valuation method resulted (Hausman, 1993, Desvousges et al., 2010). Among the papers that ultimately appeared in journals, Boyle et al. (1994) for waterfowl, and McFadden (1994) for wilderness areas, found that willingness-to-pay was insensitive to scope. There has been much criticism of the waterfowl and wilderness areas studies, including their inexpensive (at the time) survey modes (telephone and mall-intercept), open-ended valuation questions and small samples. Carson and Mitchell (1993) and Carson (1997) reexamine the Exxon-funded data and find that it does pass the scope test under certain conditions. Smith (1999) discusses survey design problems with the waterfowl survey.

The Exxon Valdez oil spill launched what has become known as the “CVM debate.” At the peak of the debate, the *Journal of Economic Perspectives* published a three paper symposium on the CVM. Portney (1994) introduced the issue and put it into context for economists who were unfamiliar with nonmarket valuation. Diamond and Hausman (1994), representing the “CVM critics,” review the anomalies and inconsistencies found in some past studies and conclude that, paraphrasing, no number is better than a CVM number. Internal scope tests, which were common in the literature, were described as weak by the CVM critics and split-sample external scope tests, also common but overlooked,² were described as strong tests and suggested as necessary for reliable CVM surveys for natural resource damage assessments (Diamond and Hausman, 1994). Hanemann (1994) argues against many of the points made by Diamond and Hausman and critiques Kahneman and Knetsch (1992) and Desvousges et al. (2010). Carson and Mitchell (1995) clarified the terms embedding, part-whole bias and internal and external scope tests. Many split-sample external tests of the CVM were subsequently conducted (e.g., Whitehead et al., 1998; Berrens et al., 2000).

Following the BP Deepwater Horizon oil spill, the *Journal of Environmental Perspectives* published a second symposium on the CVM. Kling et al. (2012) review the literature and conclude that CVM studies, especially those conducted since the beginning of the CVM debate, tend to pass the scope test. Carson (2012) reviews evidence that CVM surveys tend to pass the scope test and survey design issues that can lead to insensitivity to scope. Hausman (2012) argues that since a few selected studies do not pass the scope test and few studies have conducted an adding-up test, among other issues, then the CVM is “hopeless.” Haab et al. (2013) comment on Hausman (2012) by broadening the literature review and arguing that most CVM studies, summarized in several meta-analyses, tend to pass a scope test.³

3. Plausibility and the Adding Up Test

The NOAA Panel on Contingent Valuation (Arrow et al., 1993) was established in 1991 to arbitrate between the views of the CVM proponents and critics and develop a set of guidelines for the conduct of the CVM for natural resource damage assessment. The NOAA Panel described the scope test as a test of rationality: “Usually, though not always, it is reasonable to suppose that more of something regarded

as good is better so long as an individual is not satiated. This is in general translated into a willingness to pay somewhat more for more of a good, as judged by the individual. Also, if marginal or incremental willingness to pay for additional amounts does decline with the amount already available, it is usually not reasonable to assume that it declines very abruptly.” The NOAA Panel observed that some CVM studies fail to pass this test: “Different but similar samples of respondents are asked about their willingness to pay for prevention of environmental damage scenarios that are identical except for their scale: different numbers of seabirds saved, different numbers of forest tracts preserved from logging, etc. It is reported that average willingness to pay is often substantial for the smallest scenario presented but is then substantially independent of the size of the damage averted, rising slightly if at all for large changes in size.” In terms of guidance for future surveys they included “inadequate responsiveness to the scope of the environmental insult” as one item in a list of “maladies” that would render a CVM survey unreliable. The burden of proof fell to the researcher.

The NOAA Panel left “inadequate” open to interpretation. In a memo to the U.S. EPA, published in a report critical of NOAA guidelines for the CVM, a subset of the NOAA panel, Arrow et al. (1994) attempted to clarify adequacy when it had been confused with statistical significance: “Had the panel thought that something as straightforward as statistical measurability were the proper way to define sensitivity, then we would (or should) have opted for language to that effect. A better word than ‘adequate’ would have been ‘plausible’: A survey instrument is judged unreliable if it yields estimates which are implausibly unresponsive to the scope of the insult. This, of course, is a judgment call, and cannot be tested in a context-free manner” Arrow et al. (1994) left “plausible” open to interpretation. Synonyms for adequate include sufficient while synonyms for plausible includes believable. Sufficient responsiveness to scope suggests a threshold that must be met by the data. A believable scope effect is less restrictive, suggesting that the magnitude should be within the realm of possibility. With either, consideration of scope adequacy or plausibility is similar to the call to consider economic significance in addition to statistical significance in all fields of economics (McCloskey and Ziliak, 1996). While economists in other fields who enjoy large data sets may be guilty of ignoring economic significance, CVM researchers routinely report the magnitude of economic effects by presenting willingness-to-pay estimates that can be judged on their plausibility or believability.

In the next section we discuss how Desvousges et al. (2012) consider the adding up test as a test of adequacy. Diamond (1996) provides an example in his footnote 14: “As examples of possible adding-up tests, consider variations on two recent surveys. Schulze et al. [11] used two surveys to ask for WTP for partial and complete cleanups of the Upper Clark Fork River Basin in Montana. For an adding-up test, a third survey would describe a partial cleanup and describe the government as already committed to it, with the costs to be borne as described in the existing survey. The survey would then describe a complete cleanup and ask for WTP to enhance the cleanup from partial to complete. The mean WTP response from this question plus the mean WTP for partial cleanup should be almost exactly the same as the mean WTP for complete cleanup. One could test for the statistical significance of any difference that was found.” Diamond (1996) formalized the adding-up test in the context of the waterfowl and wilderness areas studies but does not provide an empirical test.⁴ To understand the adding-up test, consider goods A , B and C where $A = B + C$. A valuation study passes the adding up test if $WTP_A = WTP_B + WTP_C$. Due to substitution and income effects, the adding up test must be implemented by separately eliciting WTP_A , WTP_B and $WTP_C|B, Y - T_B$ where B indicates the amount of B purchased, Y is income and T_B is the cost of B . The empirical test is for whether $WTP_A = WTP_B + WTP_C|B, Y - T_B$. In contrast, a scope test is

² See Carson (1997) on this point.

³ See Desvousges et al. (2016) and Haab et al. (2016) for a comment and reply.

⁴ See Diamond et al. (1993) for an empirical test using the wilderness area data. It is not clear why these results do not appear in Diamond (1996) but consider footnote 29 in Hanemann (1994).

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