Appalachian
STATE UNIVERSITY

Department of Economics Working Paper

Number 17-01 | January 2017

A Comment on "An Adding Up Test on Contingent Valuations of River and Lake Quality"

John C. Whitehead
Appalachian State University

Department of Economics
Appalachian State University
Boone, NC 28608
Phone: (828) 262-2148
Fax: (828) 262-6105
www.business.appstate.edu/economics

A Comment on "An Adding Up Test on Contingent Valuations of River and Lake Quality"

John C. Whitehead

Department of Economics

Appalachian State University

Boone, North Carolina

January 18, 2017

Abstract. Desvousges, Mathews and Train (2015) find that their contingent valuation method (CVM) survey does not pass the adding up test. Another interpretation is that the authors do not conduct an adding up test following the required economic theory. DMT make incorrect claims about economic theory and the cognitive burden of fielding the adding up test that result in a flawed implementation of the adding up test. A correct interpretation of the survey leads to results that support the validity of the contingent valuation method.

Key Words: Contingent valuation, Adding up test, Cognitive burden, Scope test

JEL: Q51

Introduction

Desvousges, Mathews and Train (2012) critique Chapman et al. (2009) and argue that contingent valuation method (CVM) studies must pass the "adding up test" to demonstrate adequate responsiveness to scope (see also Whitehead 2016, Chapman et al. 2016 and Desvousges, Mathews and Train 2016b). Desvousges, Mathews and Train (DMT, 2015) field the Chapman et al. (2009) survey with new sample data and additional scenarios. DMT argue that willingness to pay (WTP) for the whole should be equal to willingness to pay for the sum of four parts (first, second, third and fourth increments). DMT find that "WTP for the whole is statistically different from the WTP for the second and third increments and is not statistically different from the WTP for the first and fourth increments" and "The sum of the four increments … is about three times as large as the value of the whole" (p. 566). In this comment I describe three issues. DMT make claims about (1) economic theory and (2) the cognitive burden of fielding the adding up test that result in (3) a flawed implementation of the adding up test. A correct interpretation of the survey leads to results that support the validity of the contingent valuation method.[1]

Adding Up Test

DMT (2015) provide additional comments on Haab et al. (2013) in the context of their empirical study (see also Desvousges, Mathews and Train 2016a and Haab et al. 2016). They raise a number of issues but my focus in this comment is on the adding up test theory and the

[1] See Whitehead (2017) for analysis that suggests the DMT analysis is not robust to specification of the WTP function.

associated cognitive burden. In terms of theory, DMT claim that the adding up test is a simple application of standard scope test theory:

> *Haab et al. (2013, 10) state that the adding-up test imposes additional structure on preferences beyond that imposed by the scope test and that the additional structure is unnecessary. For the scope test, they say, "A simple theoretical model of WTP, a difference in expenditure functions with changes in quality or quantity, can be used to show that WTP is nondecreasing in quality or quantity (Whitehead, Haab, and Huang 1998)." The same theoretical model, with differences in expenditure functions (as described above), is all that is needed to show the adding-up condition. The assumptions that Whitehead, Haab, and Huang (1998) use to show nonnegative scope effects for the scope test are sufficient to show the adding-up condition for the adding-up test. No additional assumptions or structure is required.* (page 559)

The adding up test is not as straightforward as DMT suggest. Consider two goods, 1 and 2. According to standard scope test theory, willingness to pay for goods 1 and 2, WTP_{1+2}, is expected to be greater than or equal to willingness to pay for good 1, WTP_1. The theoretical construct for the willingness to pay for good 2 used by DMT from Whitehead, Haab and Huang (1998) is a residual difference, $WTP_{1+2} - WTP_1$. Willingness to pay for good 2 in an adding up test makes explicit substitution and income effects, $WTP_2[2|1, Y - A]$ where $2|1$ indicates the valuation of good 2 given the provision of good 1, Y is income and A is the amount of money taken from the respondent to pay for provision of good 1. The theory for the adding up test is presented in Diamond (1996), not Whitehead, Haab and Huang (1998).

Haab et al. (2013) suggest that the adding up test would lead to additional cognitive burden on survey respondents. DMT:

> *The test requires that one part of the package of benefits be valued by respondents who are told that they already received another part. In many situations, this type of conditioning can be difficult for respondents to understand. In our application, we have been able to avoid this potential difficulty. One of the reasons we chose the Chapman et al. study is that its design is amenable to descriptions of incremental parts. As discussed below, the surveys for the incremental parts are the same from the respondents'*

> *perspective as the survey for the whole. No additional cognitive burden is imposed. In the original study for the base program (the whole), the years in which recovery will occur with and without the proposed intervention were stated to respondents. We simply changed these stated years for each of the incremental parts. In fact, this change in stated years was used in the original study for differentiating its scope and base versions, which gave us the idea that other increments could be defined similarly. In other applications, describing increments might be more difficult. But it can be useful to identify studies, like Chapman et al.'s, in which the increments can be described without undue additional burden, and to apply adding-up tests in these applications.* (page 559)

DMT do not address the counterfactual situation required by the adding up test. An explicit description of the conditions under which a valuation is made is necessary to account for income and substitution effects. For n goods, the adding up test requires $n + 1$ split-sample treatments. In the case of $n = 2$:

1. Elicit the willingness to pay for good 1
2. Elicit the willingness to pay for good 2 [after describing that good 1 has been provided at a cost of A to the respondent]
3. Elicit the willingness to pay for goods 1 and 2

Following the adding up test theory, in order to accurately elicit $WTP_2[2|1, Y - A]$ one would need to describe the provision of WTP_1 and how its provision has reduced the income of the survey respondent before elicitation of WTP_2 (scenario 2). Diamond (1996) provides this suggestion in footnote 14:

> *As examples of possible adding-up tests, consider variations on two recent surveys. Schulze et al. 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.*

Inclusion of these two counterfactual conditions in a CVM survey would likely impose additional cognitive burden on the survey respondent. Instead of this additional survey text, DMT elicit WTP_2 without consideration of substitution and income effects.

DMT use the Chapman survey with minor modifications for the first, third and fourth increment scenarios (William Desvousges, personal communication, 2015[2]). In Table 1 DMT describe the status quo as: "given that the state's current actions will induce the river to be restored in 10 years and the lake to be restored in 60 years." As described in the Chapman et al. (2009) survey, there are no current state actions except to ban alum and require the poultry industry to safely get rid of the litter that they produce. Instead of describing a government program that would provide an environmental good at a cost to the respondent, the status quo scenario results naturally from the ban and the environment improves over a long period of time at no cost to the respondent. The initial description (page 3-10) of the Chapman et al. (2009) "Base" and "Scope" scenarios are presented in Figures 1 and 2 (the complete surveys are available upon request). These are labeled the "whole" and "second" increment scenarios in DMT, respectively. Figure 1 from DMT, illustrating their five scenarios, is reproduced in Figure 3.

As an alternative to describing provision and payment of good 1 and allowing respondents to adjust their WTP in response (scenario 2 above), DMT conduct a simulation based on a statistically and economically insignificant income elasticity to show that income

[2] The online survey text used by DMT was not provided by the authors after an email request on February 18, 2015. Instead, I was provided the Chapman et al. (2009) appendices that contained base and scope surveys with an explanation that the DMT survey was the same except for minor adjustments.

effects are small. The simulation is unconvincing because it is not clear if income is the binding constraint. Respondents may have a budget for environmental goods, $Y > B$ where B is the budget, and the payment for good 1 (i.e., A) would take a larger percentage from their budget than it does from their income, $A/B > A/Y$. The amount A might expend much of their environmental goods budget so that: $elicited\ WTP_2[2|1, B-A] < simulated\ WTP_2[Y-A]$.

Conclusions

If one elicits WTP_1 and WTP_2 independently, as in DMT, theory suggests that $WTP_1 + WTP_2 > WTP_{1+2}$ due to substitution and income effects. The WTP estimates presented in DMT (2015) support this alternative interpretation of the scenarios. Instead of providing evidence that the CVM fails the adding up test, the results provide evidence that the CVM is theoretically valid.

References

Chapman, David, Richard Bishop, Michael Hanemann, Barbara Kanninen, Jon Krosnick, Edward Morey and Roger Tourangeau. 2009. Natural Resource Damages Associated with Aesthetic and Ecosystem Injuries to Oklahoma's Illinois River System and Tenkiller Lake.

Chapman, David J., Richard C. Bishop, W. Michael Hanemann, Barbara J. Kanninen, Jon A. Krosnick, Edward R. Morey, and Roger Tourangeau. "On the adequacy of scope test results: Comments on Desvousges, Mathews, and Train." Ecological Economics 130 (2016): 356-360.

Desvousges, William, Kristy Mathews, and Kenneth Train. "Adequate responsiveness to scope in contingent valuation." Ecological Economics 84 (2012): 121-128.

Desvousges, William, Kristy Mathews, and Kenneth Train. "An Adding Up Test on Contingent Valuations of River and Lake Quality." Land Economics 91(2015): 556-571.

Desvousges, William, Kristy Mathews, and Kenneth Train. "From Curious to Pragmatically Curious: Comment on "From Hopeless to Curious? Thoughts on Hausman's 'Dubious to Hopeless' Critique of Contingent Valuation"." Applied Economic Perspectives and Policy 38, no. 1 (2016a): 174-182.

Desvousges, William, Kristy Mathews, and Kenneth Train. "Reply to 'On the adequacy of scope test results: Comments on Desvousges, Mathews, and Train'," Ecological Economics 130 (2016b): 361–362.

Diamond, Peter. "Testing the internal consistency of contingent valuation surveys." Journal of Environmental Economics and Management 30, no. 3 (1996): 337-347.

Haab, Timothy C., Matthew G. Interis, Daniel R. Petrolia, and John C. Whitehead. "From hopeless to curious? Thoughts on Hausman's "dubious to hopeless" critique of contingent valuation." Applied Economic Perspectives and Policy (2013): ppt029.

Haab, Timothy C., Matthew G. Interis, Daniel R. Petrolia, and John C. Whitehead. "Interesting Questions Worthy of Further Study: Our Reply to Desvousges, Mathews, and Train's (2015) Comment on Our Thoughts (2013) on Hausman's (2012) Update of Diamond and Hausman's (1994) Critique of Contingent Valuation." Applied Economic Perspectives and Policy 38, no. 1 (2016): 183-189.

Whitehead, John C. "Plausible responsiveness to scope in contingent valuation." Ecological Economics 128 (2016): 17-22.

Whitehead, John C., "A Replication of Willingness-to-pay Estimates in 'An Adding Up Test on Contingent Valuations of River and Lake Quality' (Land Economics, 2015)," unpublished manuscript, January 18, 2017.

Whitehead, John C., Timothy C. Haab, and Ju-Chin Huang. "Part-whole bias in contingent valuation: Will scope effects be detected with inexpensive survey methods?" Southern Economic Journal (1998): 160-168.

Figure 1. Initial description of Chapman et al.'s (2009) base and scope scenarios (page 3-10)

3.7 Development of the Scope Instrument

The scope instrument was a modification of the base instrument. The major difference was a change in the description of what the alum treatments would do. In the base instrument, without alum treatments, the river and lake would return to 1960 conditions in 50 and 60 years, respectively. With alum treatments, these time intervals were reduced to 10 and 20 years, respectively. The scope questionnaire said that alum treatments were not needed for the river, which would return to 1960 conditions in about 10 years on its own, simply as the result of the ban of future spreading of poultry waste. The scope instrument also said that alum treatments for the lake would be much less effective and would return it to 1960 conditions in about 50 years.

These changes in the scenario necessitated several other changes in the base instrument to create a scope instrument that was consistent with it. Except for necessary changes, the base and scope instruments were identical. The base instrument and the scope instrument are compared in detail in the next chapter. The base and scope instrument appear in Appendices A.1 and A.2.

Figure 2. Key text from the Chapman et al. (2009) Survey

Base Scenario

As a result of alum treatments, the river would be back to what it was like in around 1960 about 10 years from now. And the lake would be back to what it was like in around 1960 about 20 years from now. …

Without alum treatments, it will take about 50 years for the river to get back to what is was like in around 1960 instead of about 10 years. That is about 40 years longer. It will take the lake about 60 years to get back to what it was like in around 1960 instead of about 20 years. That is also about 40 years longer. …

If a court bans spreading of poultry litter, the industry will have to safely get rid of all the litter they produce from now on. The industry will have to pay for this, and the river and lake will naturally return to what they were like in around 1960. If the people of Oklahoma want this to happen 40 years sooner, there will be an additional cost for the alum treatments. …

Scope Scenario

As a result of alum treatments, the lake would be back to what it was like in about 1960 about 50 years from now. …

Without alum treatments, it will take the lake about 60 years to get back to what it was like in around 1960 instead of about 50 years. That is about 10 years longer. …

If a court bans spreading of poultry litter, the industry will have to safely get rid of all the litter they produced from now on. The industry will have to pay for this. The river will naturally return to what it was like in around 1960 in 10 years, and the lake will naturally return to what it was like in around 1960 in 60 years. If the people of Oklahoma want the lake to return to what is was like in around 1960 in 50 years rather than 60 years, there will be an additional cost for the alum treatments. …

Figure 3. DMT's Figure 1

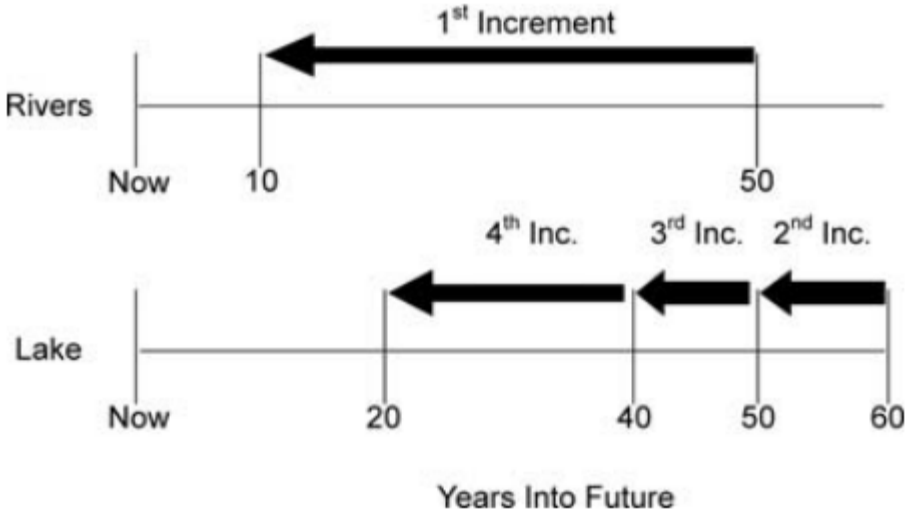

FIGURE 1
Incremental Parts of Accelerated Restoration