

Digitized by the Internet Archive  
in 2011 with funding from  
Boston Library Consortium Member Libraries

<http://www.archive.org/details/testinginternalc00diam>



DEWEY

HB31  
.M415  
no. 93-  
1

**working paper  
department  
of economics**

TESTING THE INTERNAL CONSISTENCY OF  
CONTINGENT VALUATION SURVEYS

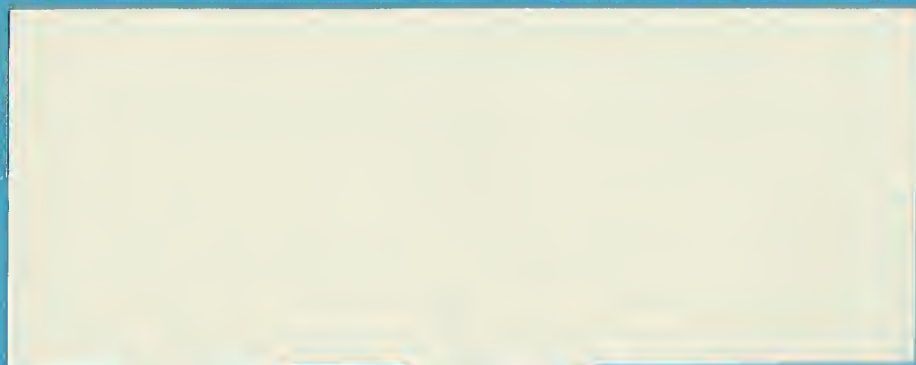
Peter Diamond

No. 93-1

Jan. 1993

**massachusetts  
institute of  
technology**

**50 memorial drive  
cambridge, mass. 02139**



TESTING THE INTERNAL CONSISTENCY OF  
CONTINGENT VALUATION SURVEYS

Peter Diamond

No. 93-1

Jan. 1993

PLATE  
MAY 31 1993  
No. 1



January, 1993

## Testing the Internal Consistency of Contingent Valuation Surveys

Peter Diamond<sup>1</sup>

There is considerable controversy about the use of contingent valuation (CV) surveys for estimating nonuse values. Moreover, the stakes in both environmental damage suits and benefit cost analyses run to billions of dollars. One of the difficulties in settling the controversy is the impossibility of having a direct comparison of CV willingness-to-pay (WTP) responses with the real world measures they are purporting to measure. In the absence of direct comparison, it is natural to look at the internal consistency of the patterns of responses to different questions using the same survey instrument. As the NOAA Panel on Contingent Valuation has written (page 4604): "some form of internal consistency is the least we would need to feel some confidence that the verbal answers correspond to some reality."

In order to compare WTP responses with the theoretical constructs, it is important to have a correct description of the theoretical constructs. In particular, different ways of varying the scenario across the surveys being compared result in different theoretical implications for the patterns of responses. If one holds an environmental problem constant and varies the success of the remedy, one would have a concave pattern of WTP with success if preferences for the underlying resource are concave. However, with the same underlying preferences, if one varies the magnitude of an environmental

---

<sup>1</sup> I thank Bernard Saffran for helpful comments. The writing of this note has received no financial support, other than the support that MIT offers for all of my research. Some of my past research on contingent valuation has been supported by the Exxon Company, USA and other industry sources. The views expressed here are mine and not necessarily those of anyone else.

problem, assuming a successful remedy, WTP should be convex in the problem. Recognition of this difference in patterns greatly increases the degree of inconsistency between some CV studies and the requirements of theory. In particular the finding of Desvousges et. al. that WTP to save migratory waterfowl is roughly independent of the number of birds to be saved from 2,000 to 200,000 is brought into even sharper conflict with theory once one recognizes that convexity of WTP calls for the latter WTP to be at least 100 times as large as the former. This argument is spelled out in a simple model.

### Model

Assume that the typical person has a utility function  $I+U(b)$  where  $I$  is income to spend on private goods and  $U(b)$  is the utility from the existence of  $b$  birds. The absence of income effects with this utility function is convenient, but not essential since one could adjust for calculated income effects. Also assume that  $U$  is strictly concave over the relevant range, although weak concavity would do. It is important to contrast the patterns of WTP responses coming from this utility function in response to two different sets of CV questions.

Assume that the respondent is told that there are  $x$  birds, but that  $z$  birds are in danger. Assume that the respondent is asked for WTP in order to save  $y$  out of the  $z$  birds in danger. The level of WTP is equal to the utility gain from saving  $y$  birds:

$$(1) \quad WTP_1(y) = U(x-z+y) - U(x-z).$$

$U$  concave implies  $WTP_1$  concave in  $y$ . Thus  $WTP_1$  would increase less than in proportion to  $y$ .

For the second scenario, assume that the respondent is told that there are  $x$  birds, but that  $y$  birds are in danger. Assume that the respondent is asked for WTP in order to save all  $y$  birds in danger. The level of WTP is equal to the utility gain from saving  $y$  birds:

$$(2) \quad WTP_2(y) = U(x) - U(x-y)$$

$U$  concave implies  $WTP_2$  convex in  $y$ . Now consider two scenarios with  $y' > y$ . From convexity and the fact that  $WTP_2(0)=0$ , we have

$$(3) \quad WTP_2(y') > (y'/y)WTP_2(y).$$

The intuition behind this pattern is similar to the one that arises in the demand for insurance. Consider a person at risk of losing  $z$  dollars. Consider the WTP for insurance that will pay  $y$  dollars in the event of the loss. This WTP is concave in  $y$ .<sup>2</sup> Alternatively, consider a person at risk of losing  $y$  dollars. Consider the WTP for insurance that will pay  $y$  dollars in the event of the loss. This WTP is convex in  $y$ .<sup>3,4</sup>

In terms of the study by Desvousges et. al., stated WTP to save 200,000 birds should be more than 100 times stated WTP to save 2000 birds. In terms of the study by Binger et. al., stated WTP to prevent development of 57 wilderness areas totalling 13 million acres should have been more than 10

---

<sup>2</sup> With  $p$  as the probability of loss, this WTP is defined by the equation  $pu(x-z)+(1-p)u(x)=pu(x-z+y-WTP)+(1-p)u(x-WTP)$ . Differentiating twice shows that WTP is concave in  $y$  if  $u$  is concave.

<sup>3</sup> With  $p$  as the probability of loss, this WTP is defined by the equation  $pu(x-y)+(1-p)u(x)=u(x-WTP)$ . Differentiating twice shows that WTP is convex in  $y$  if  $u$  is concave.

<sup>4</sup> In both the environmental and the insurance settings, varying the magnitude of the environmental problem and the magnitude of the part of the problem that isn't remedied combines elements of both WTP measures.

times the stated WTP to prevent development on one such area of 1.3 million acres. In terms of the similar study by Diamond et. al., stated WTP to preserve a particular wilderness area from development plus stated WTP to preserve an alternative wilderness area from development should be less than the stated WTP to save both areas. This pattern depends on the description of the situation that simultaneously varies the number of areas possibly to be developed along with the policy question of how many to protect from development. In all three studies, stated WTP does not come close to matching the required theoretical pattern.<sup>5</sup>

### Conclusion

Any CV survey instrument claiming to measure true WTP should be able to evaluate both WTP measures described above. Failure to find the right pattern is evidence that the appropriate preference is not being measured, either because the survey instrument is unable to measure such preferences or because people do not have the preferences that the survey is trying to measure.<sup>6</sup> I think that responses to hypothetical WTP questions about the environment are dominated by the "warm glow" associated with giving the "right" answer. Thus, I am not surprised at the failure of CV to satisfy consistency tests. I do not expect a different result if additional CV surveys are subjected to consistency tests. Thus I am highly skeptical that there will ever exist

---

<sup>5</sup> In the debate about CV, critics have tested consistency and found CV to fail this test. Proponents of CV have criticized the quality of the surveys used in these tests. I am not aware of an example of these proponents subjecting CV surveys of their own design to the same sort of consistency test.

<sup>6</sup> People may have a "concern" for the environment in general without having "preferences" over the state of individual resources.

satisfactory CV measurement of nonuse values. Policies to protect the environment need to be based on some other approach.

#### References

Binger, B. R., R. F. Copple, E. Hoffman, and K. Shacket, 1992, personal communication.

Desvousges, W. H., F. R. Johnson, R. W. Dunford, K. J. Boyle, S. P. Hudson, and K. N. Wilson, forthcoming, Measuring Natural Resource Damages with Contingent Valuation: Tests of Validity and Reliability, in J. Hausman (ed.), Contingent Valuation: A Critical Assessment, North Holland Press.

Diamond, P. A., J. A. Hausman, G. K. Leonard, and M. A. Denning, forthcoming, Does Contingent Valuation Measure Preferences? Experimental Evidence, in J. Hausman (ed.), Contingent Valuation: A Critical Assessment, North Holland Press.

NOAA Panel on Contingent Valuation, 1993, Report, Federal Register, Vol. 58, No. 10, (January 15) 4602-4614.











Date Due

OCT. 16 1995

MIT LIBRARIES DUPL



3 9080 00846364 5

