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# Is the Glass Half Empty, is the Glass Half Full? Compensable Damages and the Contingent Valuation Method

## ABSTRACT

*Should CVM values be utilized to determine an award of monetary damages for injuries to a public natural resource? Cummings and Harrison's general theme is that the values obtained from CVM and indirect method studies (such as HPM) are sufficiently inaccurate as to be deemed unacceptable in determining compensable damages. Our theme is one of tempered optimism not pessimism. More is understood about the process of assigning monetary values than when Robert Davis conducted his pioneering research and we have a better comprehension of the accuracy and the limits of this information. We argue that CVM values provide meaningful results and should be used to determine compensable damages. The courts frequently employ value estimates that have considerable variance and have developed the means of dealing with this; the courts will do the same with CVM values.*

## INTRODUCTION

The economics literature is replete with arguments that significant problems exist in efforts to determine the monetary value of public goods. These concerns are characterized as problems in designing and implementing mechanisms that would accurately reveal individual preferences. Research that forms the foundation of recent efforts to value public goods or nonmarket goods is found in works by Davis<sup>1</sup> and Randall et al.<sup>2</sup> It is interesting that the debate has once again returned to the *Natural Resources Journal* which published the Robert Davis paper acknowledged by many to be the "first" contingent valu-

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1. R. Davis, *Recreation Planning as an Economic Problem*, 3 Nat. Res. J. 239 (1963).

2. A. Randall et al., *Bidding Games for Valuation of Aesthetic Environmental Improvements*, 1 J. Envtl. Econ. & Mgmt. 132 (1974).

ation paper. Even in the early research efforts one can find discussion of many of the issues that are being debated today. As such, nonmarket valuation methods and results have been scrutinized from the early stages of development. A careful reading of the literature on the contingent valuation method would reveal that the earliest studies devoted considerable effort to addressing accuracy issues. No doubt these efforts occurred because it was recognized that determining *individual* values for nonmarket goods is a complex problem, as is determining *individual* values of market goods. The research process to date, while not complete, has yielded a better understanding of the robustness of methods of obtaining individual values for nonmarket goods.

The debate over the accuracy and appropriateness of contingent valuation method (CVM) has recently been heightened by two events; the Valdez oil spill and the Ohio case.<sup>3</sup> Suddenly, the dollars seem more real. One, however, should not forget that the dollars have been real for some time. Nonmarket valuation in varying forms has been utilized extensively in policy decisions and these decisions have involved the allocation of real dollars.<sup>4</sup> The difference at this point in time would appear to be that real dollars are potentially being required from specific entities, such as private corporations. In principle, there is little fundamental difference between the use of nonmarket values in regulatory programs or in legal settings; both affect the allocation of resources in the economy. However, at issue in this collection of papers is the appropriateness of CVM values for a new type of use: the determination of compensable damages. We feel that a broader question is appropriate. That is, should CVM values be utilized in settings where the outcome is the transfer of real dollars from one economic agent to another? These transfers arise as outcomes of government policy as well as court imposed settlement. As such, our discussion will view CVM from a more general framework: does enough evidence exist to suggest the information generated by CVM has value in a decision making process?

Our overall theme, based on the research to date, is one of tempered optimism not pessimism. We now understand more about the process of assigning monetary values than when Davis conducted his pioneering research on the value of hunting in Maine. We have a bet-

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3. *Ohio v. United States Dep't of the Interior*, 880 F.2d 432, 474-75 (D.C. Cir. 1989).

4. The USEPA has used the contingent valuation method as a tool to examine various regulatory frameworks. Arguably these efforts have had the effect of reallocating dollars in the economy.

In a recent special section of *Water Resources Research*, various authors trace the history of the use of nonmarket valuation. See, e.g., J. Loomis, *The Evolution of a More Rigorous Approach to Benefit Transfer: Benefit Function Transfer*, 28 *Water Resources Res.* 701 (1992); D. Brookshire & H. Neill, *Benefit Transfers: Conceptual and Empirical Issues*, 28 *Water Resources Res.* 651 (1992).

ter comprehension of the accuracy and the limits of the information and argue that CVM obtained values provide meaningful results, and therefore, they can and should be used to determine compensable damages absent better information. The courts frequently are called upon to employ value estimates that have considerable variance and have developed means of dealing with such variance; the courts can do the same with CVM values.<sup>5</sup>

We first address the judicial process, since a key issue is whether the judicial process can utilize information that is less than perfect. We argue that the process has demonstrated that it is capable of dealing with such information. Next we address some of our points of disagreement with Cummings and Harrison's interpretation of the literature. We discuss the role of laboratory institutions in the assessment of CVM, and present some issues regarding parallelism and external validity. We consider CVM in light of the quality of market-generated information followed by consideration of issues associated with the value of information. We are optimistic about the progress to date and do not find substantive reasons why CVM values should not be used for assigning compensable damages. We view the glass that represents the use of CVM values for determining compensable damages as being half full, not half empty.

### THE JUDICIAL PROCESS: MEASURING DAMAGES

Environmental damage cases fall into the domain of the branch of law known as torts. Central to the tort system is the payment of damages by the tortfeasor.<sup>6</sup> The role of damages is two-fold: 1) compensate the victim for the loss suffered; and 2) serve as an incentive for the tortfeasor to take cost-justified care to avoid damages. The deterrence role is best captured by the argument put forth by Judge Learned Hand which may be stated as the so-called "Hand Rule".<sup>7</sup> Denoting the probability of the loss,  $L$ , occurring as  $P$ , the magnitude of the loss as  $V$ , and the avoidance cost as  $AC$  yields the rule:

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5. The essence of the legal proceedings in the U.S. is the adversarial process. In many cases, the courts must deal with "expert testimony" in which the true answer must be demonstrated by weighing competing arguments (evidence) that speaks to the same issue.

6. The choice of rule for determining fault (negligence, strict liability (*res ipsa loquitur*), or strict liability with a defense of contributory negligence) is outside the domain of this paper. S. Shavell, *Strict Liability Versus Comparative Negligence*, 9 J. Legal Stud. 1 (1980) has discussed several arguments in favor of different rules based on transactions cost arguments. For the types of damages we are considering here—oil spills, toxic waste sites, and the like—issues of contributory negligence on the part of the victims are probably moot.

7. R. Posner, *Tort Law: Cases and Economic Analysis* (1982).

if  $P(L) \cdot V(L) > AC$ , then the agent causing the accident is deemed to be negligent for not having taken cost-justified avoidance actions.

Requiring the tortfeasor to pay damages for the harm caused provides an incentive to take care, to avoid inflicting harm, to the point where the cost of care is equal to the expected cost of the damages that result. From the perspective of economic efficiency, this is the optimal level of care. When the damages are valued in conventional markets the calculation of the appropriate compensable damages is relatively straightforward.<sup>8</sup> When the damages involve nonmarket goods, such as loss of life or environmental damages, the calculation of the monetary damages is considerably more complex.<sup>9</sup>

The courts must wrestle with many problems involving compensable damages.<sup>10</sup> For our present purposes, the most significant problem is assigning values to nonmarket goods, such as the loss of clean air or sites of national importance which have been fouled by an oil spill. In the Ohio case the court appeared to grapple with this issue and noted "the risk of overestimation has not been shown to produce such egregious results as to justify judicial overruling of DOI's careful estimate of the calibre and worth of CV methodology."<sup>11</sup>

8. Note, however, that the calculation is not independent of the overall institutional framework.

9. In the case of computing damages to provide compensation there exists a whole branch of law, remedies, where the focus is the determination of damages. It is not the purpose of this paper to delve deeply into the jurisprudence associated with this field. We will refer to this field as necessary in making our arguments concerning the appropriateness of utilizing the values generated by the CVM in determining compensable damages for environmental damages.

10. The courts have dealt with other non-market valuation problems such as value of life where the courts rely on expert witnesses and the adversarial process to weight the evidence of expert witnesses. A point which we develop later is that the courts findings are not monolithic. This does not invalidate the process.

Elsewhere, Cummings has argued that the courts' use of economic paradigms can be flawed. R. Cummings, *Legal and Administrative Uses of Economic Paradigms: A Critique*, 31 Nat. Res. J. 463 (1991). Cummings discusses two case studies. In one of the situations discussed, the 'perfectly competitive markets model' was used to determine 'just compensation'. Economists have long recognized the limitations of this paradigm and have constructed models incorporating transactions costs (including the costs associated with immobility), imperfect information, and other forms of non-competitive behavior. Thus, the problem was not with the paradigm per se but the sole use of the paradigm. In the Fort Berthod reservation example cited by Cummings, the problem is that the experts failed to include nonmarket effects. What was needed was in fact some type of nonmarket analysis that would capture more than just the market component of 'just compensation'. Thus, we would argue that whatever information was available in these regards at the time should have been used. We point this out because to do otherwise would in fact be the same as not allowing the use of nonmarket values for the determination of compensable damages.

11. *Ohio v. United States Dep't of Interior*, 880 F.2d 432, 478 (D.C. Cir. 1989).

The general principle regarding the contribution of economic analysis to the measurement of nonmarket losses is well stated by Cooter and Ulen:

It is painful for us to admit, but there are some controversial problems in tort law, like this one of computing intangible losses, that economics cannot solve. Still, let us not throw up our hands in complete despair: economics can suggest techniques of measurement that are accurate at least to a reasonable level of approximation, even for intangible damages, like the parents' loss from their child's wrongful death.<sup>12</sup>

The judicial process is an adversarial one in which all sides are permitted to present their cases and be cross-examined on the information presented. In this manner, the judge and/or jury can make an evaluation based on the information and cross examination. Thus, neither the judge nor the jury need be highly qualified in the area of the direct testimony; the adversarial process ensures that positions are challenged and defended such that lay persons are capable of evaluating the relative merits of each side. It would appear that there are sufficient checks, balances and recognition of the potential limitations to suggest that one should be positive about the use of the information.

## CUMMINGS AND HARRISON'S CRITICISM OF THE CVM-BEHAVIORAL ISSUES

### A. Overview

The spirit of Cummings and Harrison<sup>13</sup> (C&H) is that we should be pessimistic regarding the use of CVM elicited nonmarket values in the computation of compensable damages arising from man-made environmental disasters, when private entities will be held responsible.<sup>14</sup> They describe the problems with CVM as being due, in part, to the failure of respondents to accurately formulate their preferences and, in

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12. R. Cooter & T. Ulen, *Law and Economics* 331 (1988).

13. R. Cummings & G. Harrison, *Was the Ohio court Well Informed in Its Assessment of the Accuracy of the Contingent Valuation Method*, 34 *Nat. Res. J.* 1 (1994).

14. The C&H paper can be viewed in two ways. One could argue that their concerns with the extant literature are sufficiently great by virtue of their focus on individual papers that nonmarket valuation techniques are inappropriate for use in the assignment of monetary values for compensable damages. Or, alternatively, one can view their argument as being one of addressing certain conventional wisdom as to the lack of accuracy problems in the application of CVM. Regardless of their intent, their approach is to directly challenge the literature and raise questions as to the appropriateness of CVM for the assignment of compensable damages. The nature of their challenge must be regarded as one suggesting that CVM does not provide meaningful results.

part, to strategic behavior on the part of the respondents.<sup>15</sup> The combined effects result in reported values which are not representative of real economic commitment as we find in conventional market settings. They argue that evidence gleaned from experimental settings regarding strategic behavior does not provide an appropriate comparison, and they question whether individuals research their preferences absent a real economic commitment in the outcome. Since we take issue with C&H's general position we will devote only a few paragraphs to detailed discussion of their specific arguments.

## B. Strategic Behavior

There are two types of strategic behavior which may potentially compromise the usefulness of CVM to obtain compensable damage measures. The first is the classic free riding behavior whereby individuals attempt to obtain the benefits of a public good without paying. The outcome of such behavior is an *underestimate* of the value. The second, is the attempt to influence the outcome in favor of having the good provided because the individual does not feel that he or she will ultimately have to pay the stated amount. This behavior leads to an *overestimate* of values.<sup>16</sup>

C&H argue that conventional wisdom suggests that strategic behavior is pervasive.<sup>17</sup> As evidence they consider some existing CVM studies and some of the experimental literature.<sup>18</sup> C&H build their arguments, in part, on a reinterpretation of these studies. We disagree

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15. CVM researchers have characterized these problems as value formation and value elicitation and many have taken considerable care to construct their surveys to minimize these problems. The process can be multi-dimensional including the use of focus groups, pre-testing and possible reliance on laboratory results.

16. We feel compelled to point out that this second type of strategic behavior will result in under-as well as over-bidding since a properly constructed sample will include respondents who prefer the provision level to be large and respondents who prefer the provision level to be small. We are not suggesting that they cancel but only point out there will be the influence of the two behaviors in the data.

17. We emphasize tone in that C & H's approach is to consider individual studies one by one. In doing so, they challenge the assumptions and interpretations of results of the authors. Thus, it would appear they are quarreling with more than the conventional wisdom in that the studies considered by C & H do not claim to reach all encompassing results as to the existence or lack of existence of strategic behavior. They, in fact, draw conclusions within the framework of the individual study setting.

18. C&H cite Paul Samuelson's criticism of survey responses as being meaningless due to the fact that they embodied no economic commitment. Cummings & Harrison, *supra* note 13, at 5 (citing P. Samuelson, *The Pure Theory of Public Expenditure*, 3 Rev. Econ. & Stat. 386 (1954)). We point out that this comment was made in 1954. Since then there has been considerable economic research which suggests that Samuelson's pessimism was overstated. R. Cummings, et al., *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method* (1986), suggest that Samuelson recanted a bit later see P. Samuelson, *Aspects of Public Expenditure Theories*, 40 Rev. Econ. Stat. 332 (1958). Further, a great deal of laboratory work suggests that free riding is not as pervasive as Samuelson stated it would be.

with their method of analysis and with their reinterpretation.<sup>19</sup> Our reading of the literature is that, while CVM might not be entirely free of strategic behavior, there is considerable evidence that strategic behavior is not as widespread as many early economists thought. Further, we know of no studies that suggest that strategic behavior is so dominant as to completely invalidate CVM.

The experimental literature in economics, psychology, and political science is often cited as providing evidence that free riding is not pervasive even in institutions in which the dominant strategy is to contribute zero.<sup>20</sup> In the laboratory sessions conducted by Isaac, McCue, and Plott,<sup>21</sup> no subject consistently posted a zero contribution—even after posting zero in an earlier stage. Further, while total contributions were below the efficient level, they never declined to zero as predicted by the theory. As other social scientists have argued, rational societies do not evolve institutions which are characterized by dominant strategy equilibria which are not Pareto optimal.<sup>22</sup> Thus, individuals will not play strategies consistent with prisoner's dilemma settings even when forced, by experimental design, into such settings. Since we live

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19. C&H analyze the study R. Rowe et al., *An Experiment on the Economic Value of Visibility*, 7 J. Envtl. Econ. & Mgmt. 1 (1980) which attempted to measure the extent of strategic bias in CVM survey responses. Respondents self-labeled themselves according to their degree of "environmentalism" and RDB used this information to check whether such attitudes had an effect on the WTP reported by the respondents. RDB report that the correlation between attitudes and bids is zero, indicating a lack of strategic bias. It would appear that C&H misinterpreted the study in that a separate dummy was included for each class of (self-reported) environmental stance and in all cases the coefficient was zero. On the strength of this observation, and for the setting of this survey, strategic bias would appear to be absent as tested for in the study.

D. Brookshire et al., *The Valuation of Aesthetic Preferences*, 3 J. Envtl. Econ. & Mgmt. 325 (1976) reports on the results of a CVM study designed to, in part, test the problem of free-riding in CVM surveys. C & H criticize a central assumption regarding the information the respondents were required to infer in order for the test to be applied. We think that they erred in the inference they draw regarding the conjectures required of the respondents. It is not true that only the last person is capable of inferring the mean bids of the other respondents. All respondents were, in effect, responding simultaneously to the survey. By introspection each person would infer bids posted by the others. In the jargon of game theory, this setting requires the respondents to make conjectures regarding the behavior of the other agents. Essentially then, C & H offer the conclusion, based solely on their discomfort with underlying behavioral assumptions, that the BIS study does not "provide a basis for unequivocal conclusions regarding . . . [free-riding] . . . behavior." Cummings & Harrison, *supra* note 13, at 23. Of course, Brookshire, et al., *supra* never made such an assertion.

20. Nor, we would note that the literature ever unambiguously argues that free riding is not prevalent to some degree. There are few absolutes, and this especially applies in the case of free riding.

21. M. Isaac et al., *Public Goods Provision in an Experimental Environment*, 26 J. Pub. Econ. 51 (1985).

22. R. Axelrod, *The Evolution of Cooperation* (1984); M. Taylor, *The Possibility of Cooperation* (1987).



in more cooperative settings, it is not in our nature to free ride to extremes.<sup>23</sup>

C&H imply that laboratory results addressing strategic behavior are suspect because of the divergence of the reported results across the various studies they cite. There is a good reason for this. The incentives faced by the subjects are different across these studies by virtue of the different institutional settings established in each of the laboratory investigations. In the Isaac, McCue and Plott study the subjects were offered a clear private incentive to free ride. It is difficult to identify the incentives in Harrison and Hirshleifer.<sup>24</sup> In the voluntary contribution mechanism of Isaac and Walker, subjects' incentives to free ride depended on their conjectures regarding the behavior of others in the group. The most interesting fact gleaned from the experimental literature is that, even when the dominant strategy for individual subjects is to contribute zero toward the public good, we do not observe widespread free riding. As we noted above, this literature suggests that free riding is not pervasive, as early economists would have us believe. To restate, individuals will not play strategies consistent with prisoner's dilemma settings even when forced into such settings.

In developing the "revelation principle", Myerson argued that, if it is costless to tell the truth (as in no return to lying), then individuals will do so.<sup>25</sup> In the case of CVM, the very characteristic that C&H criticize (hypothetical markets) is what would allow one to invoke this revelation principle to argue that bids obtained via CVM represent true preferences.

To conclude, we find nothing in C&H's interpretation of the literature regarding the prevalence of strategic behavior that would lead us to reject the use of CVM to derive measures of compensable damages. Since this is ultimately an empirical question, what is really needed at this juncture is a study which systematically investigates the nature of strategic behavior in CVM.

### C. Preference Research

C&H argue that the CVM setting is "purely hypothetical" and, as such, the respondents have little incentive to actually think about the values they reveal for the good being valued by the CVM study. The result is that the values obtained with CVM questionnaires will show considerable variance over time. There are two behavioral issues

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23. James Andreoni has developed a theory that people donate to charities because they "feel good" about doing so. See J. Andreoni, *Giving With Impure Altruism: Applications to Charity and Ricardian Equivalence*, 97 J. Pol. Econ. 1447 (1989).

24. The experimental design failed to implement Hirshleifer's theory. The subjects were given incomplete information concerning the payoffs of their "partners" despite the theoretical requirement for complete information.

25. In his text David Kreps provides a compact discussion of Myerson's revelation principle. See D. Kreps, *A Course in Microeconomic Theory* (1990).

being raised here. The first is whether respondents view the CVM setting as purely hypothetical. The second is whether they investigate their preferences absent the requirement that they be in a position to immediately pay for the good. We will return to this point later, but for now we simply note that there is a great deal of literature suggesting that individuals do research their preferences even when transactions are not imminent.

In conventional markets is there any reason to believe that preferences are stable over time? Theory would suggest that preferences will not be stable over time as new information is made available. As such, changing values over time is in of itself not sufficient to reject CVM.

The issue of the effect of hypothetical settings has been addressed in several laboratory experimental studies which have placed subjects in the position of making decisions in environments in which the payoffs were purely hypothetical. The general finding is that the results are very similar to those obtained in settings where the payoffs are real. In fact, the only consistent result is that bids in hypothetical settings have higher variances than those in settings which use monetary payoffs.<sup>26</sup> The psychologists Kahneman and Tversky reported experimental results which contradicted the predictions of economic theory concerning decisionmaking under uncertainty. Yet, when economists have conducted similar experiments with (sometimes substantial) monetary payoffs, these contradictions have persisted.<sup>27</sup> The weight of the evidence from empirical investigations is that the behavior is similar, whether or not the subjects are paid directly for their decisions.<sup>28</sup>

C&H imply that individuals do not have a real economic commitment unless the individuals participating in the experiment or responding to the CVM survey actually have to put up their "own" money. The conventional experimental setting involves paying the subjects on the basis of the decisions they make. This is a real economic commitment that falls squarely within the economist's concept of opportunity cost; costs are foregone opportunities. A pointed illustration whereby behavior is affected by such foregone opportunities is provided by the

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26. See V. Smith & J. Walker, *Monetary Rewards and Decision Cost in Experimental Economics*, *Econ. Inquiry*; Seigel, *Decision Making and Learning Under Varying Conditions of Reinforcement*, 89 *Annals N.Y. Acad. Sci.* 766 (1961).

27. D. Kahneman & A. Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 *Econometrica* 263 (1979); D. Grether & C. Plott, *Economic Theory of Choice and the Preference Reversal Phenomenon*, 69 *Am. Econ. Rev.* 623 (1979); S. Kachlemer & M. Shehata, *Examining Risk Preferences Under High Monetary Incentives: Experimental Evidence from the People's Republic of China*, 82 *Am. Econ. Rev.* 1120 (1992).

28. There is a considerable literature on the topic discussed in this paragraph. Some examples are: J. Irwin et al., *Hypothetical and Real Consequences in Experimental Auctions for Insurance Against Low-Probability Risks*, 5 *J. Behavioral Decision Making* 107 (1992); V. Smith & J. Walker, *Rewards, Experience and Decision Costs*, *Econ. Inquiry* (forthcoming 1994).

work of Kachelmeir and Shehata who conducted experiments in China with payoffs of up to three months' earnings. They found that behavioral anomalies persisted that were observed in experiments with much smaller cash payoffs.<sup>29</sup>

Another dimension of preference considerations is the stability of preferences over time. However, simply observing different bids across time is not inconsistent with CVM yielding reliable values. Economists frequently dismiss the question of tastes as being outside their domain. An exception is the work of Stigler and Becker<sup>30</sup> and West and McKee.<sup>31</sup> Stigler and Becker postulated that consumers are engaged in the production of consumption commodities from market goods and their own time. Thus, one does not "consume" compact discs; one consumes "music enjoyment", which is produced with compact disks, a compact disk player and the individual's time input. The productivity of the time input and the choice of mix of market good inputs will vary as the individual acquires skills and information. Thus, one may initially produce music enjoyment with a modest stereo system. Over time, continued enjoyment of music leads to an increase in the individual's skill level and which leads to further expenditure on the market inputs (compact disks and stereo equipment). That is, the individual responds by increasing expenditures on the market goods used to produce music enjoyment. So, we observe an increase in demand for these goods. Although this would appear as increased WTP (and market prices being bid up if the supply is not responsive), we would not argue that this implies that market prices are unreliable or that tastes are unstable.

This same argument extends to environmental goods. As more information concerning environmental issues becomes available, the willingness to pay for environmental amenities will change. Increases in knowledge are generated by experience and by information that is provided by others. Thus, if information available to consumers changes over time - and over a long time span we would certainly expect such changes-then the demand will change and we should expect to observe differences in WTP.<sup>32</sup> The direction of the change is an empirical question.

The effect of information on stated WTP values may be inferred from studies which have given respondents "time to think". There are not many such studies and the results are mixed. Kealy et al<sup>33</sup> report

29. See Kachelmeir & Shehata, *supra* note 27.

30. G. Stigler & G. Becker, *De Gustibus Non Est Disputandum*, 67 *Am. Econ. Rev.* 76 (1977).

31. E. West & M. McKee, *De Gustibus Est Disputandum: The Phenomenon of Merit Wants*, 73 *Am. Econ. Rev.* 1110 (1983).

32. With this argument we are clearly questioning the appropriateness of the time-consistency argument that has appeared in the literature.

33. M. Kealy et al., *Reliability and Predictive Validity of Contingent Values: Does the Nature of the Good Matter?*, 19 *J. Envtl. Econ. & Mgmt.* 205 (1990).

that the overwhelming majority of their respondents did not revise their bids over a two-week period. This behavior was identical for both the public and the private good. This result is consistent with the small changes in information which we should expect to occur given the brief time frame for updating information. However, Whittington et al.<sup>34</sup> find that giving subjects more time to think, which might be viewed as more information, leads to a downward revision of bids. There is simply not enough evidence to draw an unambiguous conclusion at this time.

It is clear that we should not reject use of CVM on the grounds that preferences are not consistent over time. This observation is true of market goods as well, as shown by the proliferation of fads and fashions. In fact, we should be suspicious of values that are static over time, because this might suggest that consumers are blissfully ignorant of the information being provided daily through various media.<sup>35</sup>

### LABORATORY INSTITUTIONS AND CONTINGENT VALUATION INSTITUTION

C&H raise questions as to the appropriateness of utilizing laboratory experimental settings and associated results to draw inferences concerning CVM. Their approach is to compare the institutional characteristics of the laboratory settings and field settings. As Smith<sup>36</sup> demonstrated, microeconomic systems have a basic structure consisting of environments (the agents, their tastes and endowments, and the production technology) and institutions (the messages agents may send, the property rights to be enforced, and the market adjustment process). The effect of varying institutions is an empirical question and requires systematic investigations. We disagree with the C&H characterization of the Smith auction and the voluntary contribution mechanism (VCM). Our reading of the basic setting of both the Smith auction and the VCM is:

1. Subjects have private wealth<sup>37</sup> which they receive when they arrive at the laboratory;
2. The subjects must choose to allocate their wealth either to the private good with a certain return or to the public good where the return is dependent on the behavior of the others in the group.

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34. D. Whittington et al., *Giving Respondents Time to Think in Contingent Valuation Studies: A Developing Country Application*, 22 J. Envtl. Econ. & Mgmt. 205 (1992).

35. Historically, uses of values such as unit day values as put forth by the U.S. Forest Service did just this.

36. U. Smith, *Microeconomic Systems as an Experimental Science*, 72 Am. Econ. Rev. 923 (1982).

37. This is not a loan as C&H describe it. This is the subject's initial wealth and is not to be repaid at some point in the future. The subject may choose to keep this money or to invest it in the laboratory market.

These institutions differ in the provision rule for the public good. Under the Smith auction, the good is provided if the costs are covered by the total contributions and the members of the group unanimously agree to the distribution of the burden of providing the good. No one has seriously suggested that the strict version of the Smith auction be applied as the provision rule in a CVM survey instrument.<sup>38</sup> Therefore, it is inappropriate to compare the institution presented to the subjects in the Smith auction with that in CVM. Recognizing this point, several researchers have investigated the properties of the Smith auction modified in various ways to make it tractable for field applications. Thus, a more appropriate question is: how do these modified Smith auction mechanisms compare to CVM, and how do the results compare to the stricter versions of the Smith Auction?<sup>39</sup> As such, an appropriate test would compare the results of a basic institution along a "gradient" of changes in the characteristics of the institution. This is based upon our notion that the provision rule embodied in the modified Smith auction<sup>40</sup> is a candidate for use in a CVM survey questionnaire.

Under the VCM, the good is provided continuously as contributions increase. The production function of the good is such that, beyond a given level of total contributions, all members would benefit from devoting their entire private wealth to the provision of the public good. This mechanism has been found to yield fairly high levels of voluntary provision even when group sizes are quite large.<sup>41</sup> This public good production function that underlies this mechanism is consistent with the provision of many public goods. Thus, the provision rule embodied in the VCM is also a candidate for use in a CVM survey questionnaire.

An emerging strand of literature not included by C&H concerns public goods provided under a threshold provision rule. That is,

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38. No one has suggested using the Clarke tax, see E. Clarke, *Multipart Pricing of Public Goods*, 11 *Pub. Choice* 17 (1971), to finance national defense.

39. There are several variants of the Smith auction that have been applied in the literature. See D. Coursey & V. Smith, *Experimental Tests of an Allocation Mechanism for Private, Public or Externality Goods*, 86 *Scandinavian J. Econ.* 468 (1984); J. Banks et al., *An Experimental Analysis of Unanimity in Public Goods Provision Mechanisms*, 55 *Rev. Econ. Stud.* 301 (1988); D. Brookshire et al., *Special Interest and the Voluntary Provision of Public Goods* (1992) (unpublished manuscript). As a research strategy, these researchers have taken the approach of modifying the Smith auction in the laboratory to the end of designing a mechanism that is feasible to employ in field surveys. That is, they have investigated the robustness of the institution to changes in some of the underlying assumptions of Smith's original experimental investigations. The motivation for this program of research is clear—the Smith auction in its pure form is not amenable to field applications with even moderately sized groups.

40. D. Brookshire & D. Coursey, *Measuring the Value of a Public Good: An Empirical Comparison of Elicitation Procedures*, 77 *Am. Econ. Rev.* 554 (1987).

41. M. Isaac & J. Walker, *Group Size Effects in Public Goods Provision: The Voluntary Provision Mechanism*, 103 *Q.J. Econ.* 179 (1988).

goods which will be provided only if the aggregate contributions are sufficient to cover the cost of provision. This contribution game institution is similar to the Smith auction but does not require the ex post unanimity condition. The contribution game has been shown to be robust in the type of one-shot setting that characterizes CVM surveys.<sup>42</sup> The provision rule embodied in the contribution game is a candidate for use in a CVM survey questionnaire.

Now, let us review the task facing the respondents in a CVM survey and compare these tasks with those of the public good provision mechanisms discussed above. In a CVM survey the respondents are asked:

1. To place themselves in the context of bidding to have a public good supplied in a market setting which might potentially arise;
2. To state how much of their private wealth they would wish to give to the provision of the public good contingent on the good being made available. The elements of the contingent market are:
  - a. The public good is described in quantity, quality, location, and time dimensions.
  - b. The rules of the contingent market, such as payment vehicles, are described.

This institutional setting is clearly similar to that in the public good provision experiments described above.

Accepting the notion that institutions do matter, Smith's paradigm provides a framework in which to evaluate the effects of institutions within economic systems or markets. He demonstrates that we can compare behavior as institutions vary by investigating the effects of the components of the institutions the messages players are permitted to exchange, the allocation rules of the markets, and the rules for determining payoffs. Economic theory tells us something about which of these may be varied (and by how much) without significantly altering the allocative results. Where the theory is silent, we must rely on empirical work.<sup>43</sup> In the final analysis, it is an empirical question whether the results differ.

Empirical evidence exists suggesting that, as one walks along a "gradient" of institutions, consistent results are obtained. One such study by Brookshire and Coursey, where they compare the results of a

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42. See, e.g., R. Prince et al., *Improving the Contingent Valuation Method: Implementing Contribution Game Behavior*, 23 J. Env't. Econ. & Mgmt. 78 (1992); M. Bagnoli et al., *Voluntary Provision of Public Goods: the multiple unit case*, 47 J. Pub. Econ. 85 (1992).

43. Thus questions as to whether the subjects perceive their initial endowment as a loan, the importance of the veto power, whether the cost information is presented are all testable hypotheses in the context of the institution.

laboratory Smith Auction, a field Smith Auction, and a set of contingent valuation results.<sup>44</sup>

When making inferences concerning behavior in the field based on observations from the laboratory, one must address questions of "parallelism" or "external validity". Parallelism is satisfied when the experimental design places the subjects in a decision setting that mimics that faced in the field.<sup>45</sup> Economic decisions are made in the context of institutions. Parallelism requires that the institutional characteristics of the laboratory capture the essential features of the field setting being studied. For example, if the field setting involves risk then the level of risk in the laboratory should be similar to that in the field. If collective decisions are encountered in the field then these should be present in the laboratory economy also. When the parallelism condition is met the results of the laboratory may be generalized to the field.<sup>46</sup>

The institutional feature that C&H wish to use to reject the use of CVM to obtain values is the notion that CVM survey respondents lack a "real economic commitment". Absent a theory of decision costs in decision making, this argument falls victim to the same criticism that may be made of Harrison's earlier work on payoff dominance.<sup>47</sup> That is, the argument must be based solely on heuristic arguments that the available rewards are insufficient to induce agents to select optimal behavior. Individuals are not rewarded for good decisions nor punished for bad decisions. Does this imply that individuals have no incentive to think about and state their preferences?

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44. See *supra* note 40 (modified Smith auction). C & H reject the results of Brookshire & Coursey's 'trees' study on the grounds that some of the groups failed to reach unanimity within the available time period. Note that the closure properties of the Smith auction that is unanimity, are extremely stringent. Individuals time period. Note that the closure properties of the Smith auction that is unanimity are extremely stringent. Individuals who wish to extract the last increment of surplus may hinder the group. As is common in much of experimental methodology the authors elected to end the session when the subjects were 'close' to agreement. The subjects were unaware of the ending point of the experiment if unanimity was not achieved and would therefore choose strategies on the equilibrium path. C & H argue that these "out of equilibrium" bids convey no information but this rejects the notions of general equilibrium and the Walrasian atonement process. Markets converge to an equilibrium as agents send signals agents via their bids. Agents have no incentive to send misleading bids since this will slow the convergence of the market toward equilibrium and reduce the payoffs to the agent. Thus, the final bids recorded by B & C cannot be dismissed as irrelevant. C & H's replacement of these bids by zeros is incorrect, thus their conclusions are misleading.

45. See C. Plott, *Dimensions of Parallelism: Some Policy Applications of Experimental Methods, in Laboratory Experimentation* in *Econ.: Six Points Of View* 193 (A. Roth ed., 1987).

46. See D. Grether & C. Plott, *The Effects of Market Practices in Oligopolistic Markets: An Experimental Examination of the Ethyl Case*, 22 *Econ. Inquiry* 479 (1984).

47. G. Harrison, *Theory and Misbehavior in First-Price Auctions*, 79 *Am. Econ. Rev.* 749 (1989). Several experimentalists have taken issue with Harrison's arguments. See, e.g., A. Merlo & A. Schotter, *Experimentation and Learning in Laboratory Experiments: Harrison's Criticism Revisited*, *Am. Econ. Rev.* (forthcoming 1994); Smith & Walker, *supra* note 28.

This is an empirical question. Smith and Walker,<sup>48</sup> for example, demonstrated that decision costs matter when the task is complex.<sup>49</sup> Dickie, Fisher, and Gerking reported observations of similar demand behavior for hypothetical sales of strawberries and for actual sales.<sup>50</sup> Brookshire and Coursey<sup>51</sup> conducted a study to compare the values that individuals report for a given public good (in this case additional trees in a park) under two different elicitation mechanisms. They reported the results of a comparison between CVM and a version of a Smith auction.<sup>52</sup> They found that the results are statistically identical as demonstrated by the coefficient on the institutional dummy being statistically equal to zero. Brookshire, Coursey, and Schulze examined parallelism between demand behavior from the sale of a private good in an actual setting and in a laboratory setting.<sup>53</sup> Prince, McKee, Ben-David, and Bagnoli required subjects to enter hypothetical bids and actual bids.<sup>54</sup> The bidding behavior was identical in the hypothetical setting and in the setting which required cash payments to be made.

Similar arguments may be made in the context of indirect estimation methods. A frequently applied indirect method is the hedonic price method (HPM).<sup>55</sup> The value that individuals place on a nonmarket good is derived from the price of a complementary market good. Consider, for example, two houses identical in all respects except that one is in an area in which the ambient air quality is better. If people value good air quality, this will be reflected in a higher price for the house located in the area of higher air quality. The observed price differential will be the WTP for higher ambient air quality. In practice, however, houses differ in several characteristics and an accurate estimate of the WTP for air quality will require some sophisticated econometric investigations using data from hundreds of home sales in a given metropolitan area.

The housing market is particularly useful for the estimation of hedonic values. First, the housing market itself is well developed since a sizeable fraction of the housing stock is traded in a given year. Second, housing is location-specific, allowing the identification of specific

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48. Smith & Walker, *supra* note 26.

49. See also E. Beckett et al., *Incentive Compatibility of the BDM: The Roles of Cognitive Transparency and Payoff Dominance* (1991) (unpublished manuscript, University of Colorado, Boulder, CO); J. Irwin et al., *supra* note 28.

50. M. Dickie et al., *Market Transactions and Hypothetical Demand Data: A Comparative study*, 82 J. Am. Stat. Ass'n 69 (1987).

51. See *supra* note 40.

52. The Smith auction involved the respondents spending real dollars according to their stated WTP. Hence this money was actually collected from the individuals.

53. D. Brookshire et al., *The External Validity of Experimental Economics Techniques: An Analysis of Demand Behavior*, 25 Econ. Inquiry 239 (1987).

54. See Prince et al., *supra* note 42.

55. D. Brookshire et al., *Valuing Public Goods: A Comparison of the Survey and Hedonic Approaches*, 72 Am. Econ. 165 (1982).



amenities such as air quality. Third, the housing market has several institutional features which ensure that trades take place at efficient prices. Furthermore, because real estate agents are adept at market making and financial institutions extend housing loans on the basis of expected resale values, location factors are fully incorporated into prices.

It is interesting to note that in the Brookshire et al. study of the hedonic price effects of air quality in Los Angeles, the values obtained via CVM are below those obtained from HPM as predicted by the theory.<sup>56</sup> This suggests that CVM is capable of providing consistent estimates of the values produced by HPM.

## WELL DEVELOPED MARKETS-A STANDARD OF COMPARISON?

### A. Introduction

In their critique of CVM, C&H implicitly hold CVM to the standard of market-determined prices. We noted earlier that the courts often place values on nonmarket goods, and that the techniques used for valuing these are similar to those used for environmental goods. This alone suggests that courts are willing to abandon the market standard when necessary. However, we wish to pursue this issue because we maintain that the "market standard" advanced by C&H is an artifact of a particular class of markets that economists use for illustration only. In fact, most market prices suffer from the same sorts of statistical features that C&H ascribe to CVM values. For a given good there is typically a range of market prices, and the distribution of these prices is not necessarily normal. In fact, only in perfectly competitive markets that are in long-run equilibrium do prices converge to the single equilibrium price that is depicted in textbook models.

### B. Theoretical Foundations of CVM

We now turn to the theoretical foundations of CVM. Whether CVM does or does not satisfy the "assumptions" of neo-classical economics is a testable hypothesis. Recent work suggests that individual behavior often violates the behavioral assumptions of neoclassical economic theory. Expected utility theory, in particular, is a poor predictor of individual behavior for some persons, even when the sums of money at stake are very large.<sup>57</sup> However, markets force convergence across individual behavior with the result that the *market* behaves according

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56. See D. Brookshire et al., *A Test of the Expected Utility Model: Evidence from Earthquake Risks*, 93 J. Pol. Econ. 369 (1985).

57. See *supra* note 27.

to the theoretical predictions.<sup>58</sup> Thus, the market produces something different from a simple aggregation of individual choices. It is the interaction of the supply and demand sides of the market that provide the apparent precision in market recorded prices. These prices are not simple WTP values for the individual consumers in the market.

We reiterate our earlier proposition that the decision-making underling economic theory is behavioral, and contextual. Institutions affect economic decisions and comparisons across institutions are relevant.<sup>59</sup> Our contention is that a theoretical challenge of CVM must be set forth in a testable hypotheses framework and the debate should be centered on accuracy and other empirical issues.

### C. Contingent Markets Versus Hypothetical Markets

As originally conceived,<sup>60</sup> a CVM survey instrument is designed to create in the minds of the respondents a contingent market for the provision of a public good. Contingent markets form an essential function in economic analysis and in the workings of the economy itself. The world is characterized by many potential states of nature, only one of which may be realized. It is essential that economic agents be able to write contracts which specify the allocation of resources over all possible states of nature.<sup>61</sup> In their simplest form, insurance contracts are such instruments. In order to purchase insurance, an individual must undertake the same sorts of calculations that are required in responding to a CVM survey. That is, one must evaluate a potential loss contingent on a fire or other disaster and decide whether the price of this contingent contract is below one's WTP. While the premium paid is not hypothetical, the remainder of the contract is effectively hypothetical since the payoff on the contract will only take place contingent on the fire or the disaster. For this market to function it requires that individuals undertake the same task as required of a respondent to a CVM survey.<sup>62</sup>

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58. Both the Brookshire study, see Brookshire et al., *supra* note 56, and a study by Colin Camerer, see C. Camerer, *Do Markets Correct Biases in Probability Judgment? Evidence from Market Experiments*, 2 *Advances In Behavioral Economics* 126-172 (J. Kagel & L. Green eds., 1990), support the position that markets perform a significant convergence function regarding individual behavior.

59. We had hoped not to use the word 'truth' in this paper. We would suggest that there is no truth, but only concerns of accuracy.

60. R. Bishop et al., *Hypothetical Bias in Contingent Valuation: Results from a Simulated Market*, 23 *Nat. Res. J.* 619 (1983) describe CVM as the use of surveys and/or interviews "to ask people about the values they would place on non-market commodities if markets did exist. That is, subjects are asked about their willingness to pay or compensation demanded, contingent on the creation of a market...." *Id.* at 619 n.1.

61. See K. Arrow & F. Hahn, *General Competitive Analysis* (1971), for a comprehensive analysis of the role of contingent claims contracts in facilitating economic equilibrium under uncertainty.

62. See D. Brookshire & T. Crocker, *The Advantages of Contingent Valuation Methods for Benefit-Cost Analysis*, 36 *Pub. Choice* 235 (1981).

All financial instruments are contingent contracts. Further, all contracts which are not spot transactions involve uncertainty and are resolved through contingent contracting. The central issue is not hypothetical markets but contingent markets. Therefore, what should be debated is whether real economic commitment is a significant factor for the accuracy of CVM results since this is the difference between a CVM setting and these other contingent contracts.

#### D. Relevance of CVM Distributions

Economists accept that well-developed markets provide good information concerning prices. A particularly robust market institution is the oral double auction market such as that used for securities trading on the New York Stock Exchange. The structure of this market provides a great deal of information concerning "bids" and "asks" to the traders in the market, which contributes greatly to convergence to an equilibrium price. However, when we review the results of laboratory double auction markets, we observe many trades taking place at prices other than the equilibrium price. Does this imply that markets provide unreliable information regarding preferences? Clearly this is not the case. None of the trades at non-equilibrium prices result in a loss to the traders.<sup>63</sup> Even with the "real economic commitment" inherent in this market setting we still observe variance in the prices at which trades take place.

Thus, one cannot reasonably assert that the frequency distribution of the bids obtained from CVM surveys provides evidence that a large variance observed in CVM bids is proof that the method yields inaccurate values. Indeed, no inference can be obtained concerning the accuracy of a preference elicitation technique from studying the distribution of bids unless we assume, *a priori*, that everyone assigns the same value to the good. Researchers have investigated a myriad of measures of central tendency (mean, median, and mode) and of the higher-order moments (variance, skew, and kurtosis) of the distributions of the values obtained from survey respondents. There is no *a priori* reason to expect the distribution of willingness to pay along a market demand schedule to have a normal distribution with a small variance. The consumers' valuations may be clustered at any point along this demand curve, not necessarily at the market clearing price.

It follows that the observation of a large variance in reported WTP values by CVM respondents is not a sufficient condition to reject the use of CVM to obtain values for nonmarket goods. In any market, the range of the distribution of individual values is likely to be large.

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63. It is interesting to note that there is generally greater price volatility for securities on the NYSE within a given *day* than across average daily prices within a *month*.

If the individuals in a market for a public good were asked to state the values they assign to the good, we would obtain a range of values that reflect the individual differences in the vertical heights of their demand curves.

Therefore, markets simply tell us a great deal about equilibrium prices - the price at which the marginal trades take place. They tell us much less about inframarginal prices, because we rarely observe these prices. The apparent precision of market prices is due to interaction between the supply and demand. That is, observing a price for unleaded gasoline of \$1.15 per gallon does not necessarily mean that no individual would be willing to pay \$2.50 for a gallon.

CVM is designed to elicit valuations which should be expected to be different across individuals. The courts are accustomed to dealing with variances in damages suffered for like accidents. For example, in the classic "eggshell skull" problem,<sup>64</sup> the courts have evolved the principle that the tortfeasor take the victim as originally found. As Richard Posner notes-"the principle that the tortfeasor is fully liable for his victim's damages even if the extent of those damages is unforeseeable is well established in tort law."<sup>65</sup> That is, the same tort action may result in much different damages being awarded depending on the circumstances of the particular victim. The courts do not refuse to award damages simply because there is considerable variance across victims or because there is considerable agreement among experts as to how to best compensate the loss.

Market outcomes cannot serve as an absolute standard of comparison. There are many different market structures, and these will generate different types of market conduct, for example, pricing behavior. Only in perfectly competitive markets<sup>66</sup> do market prices fully reflect real resource costs. As soon as we drop the assumptions of perfect competition this correspondence disappears. In particular, many markets are characterized by the presence of a range of prices for objectively identical products. Anyone shopping for a personal computer is aware of this. Gasoline prices are more similar, since stations now post prices, but there is still some variations within the same city. Therefore, the competitive market cannot be an absolute standard against which to gauge the performance of nonmarket value elicitation methods.

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64. This is a setting in which an injured party suffers extraordinary harm due to a condition that is unobservable by the party causing harm.

65. See R. Posner, *Tort Law: Cases and Economic Analysis* 26 (1982).

66. A standard sometimes incorrectly applied as the only valid economic paradigm. Cummings, see Cummings, *supra* note 10, argues that the courts often fall victim to bad economics. The issue is not economics but the application of bad economics and therein lies the dissolution of Cummings' parable.

## DECISIONMAKING AND THE VALUE OF INFORMATION

Consider a court facing the task of awarding compensable damages to an individual for losses suffered due to an environmental accident. C&H's general theme is that the values obtained from CVM and indirect method studies (such as HPM) are sufficiently inaccurate as to be deemed unacceptable in determining compensable damages. We have argued to the contrary regarding the evidence to date concerning the accuracy of these studies. Further, an essential element of tort law is the awarding of compensable damages. The courts must make some determination of the damages. In general, a court may refuse to award damages if they are too speculative. But here, Congress has ordered the court to calculate the damages by the best available methods. Therefore, the court is justified in using CVM because, although not perfect, it is the "best available" method.

Absent information concerning the losses, the courts would be forced to assign a value of zero. Not using the available information (the values estimated via CVM) implies that the courts will possibly not assign penalties at all. This outcome defeats the purpose of awarding damages and the intent of Congress: unless the penalty approximates the loss, the tortfeasor will not take cost-justified mitigation or avoidance. If we argue that we have *no* acceptable method to estimate damages, then we are effectively arguing that the damages must go uncompensated.<sup>67</sup> The consequences of adopting this position is that tortfeasors will not have an incentive to take appropriate care and we will have socially inefficient levels of environmental damage.

We have argued that CVM elicited values provide meaningful estimates. Therefore, use of the information is justified if the losses avoided by such use the information exceed those from not using the information. Under this rule, those who wish to reject the use of CVM-obtained values must demonstrate that the information has no merit.<sup>68</sup>

The above comparison involves the weighing of two types of errors: overvaluing and undervaluing losses. Such problems are regularly encountered in statistics when dealing with Type I and Type II errors. If we begin with no information, the best we can do is assign a uniform distribution to our estimate of the value of the environmental damages. The information from a CVM study (or other nonmarket valuation study) allows us to update this prior distribution by employing

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67. One could always resort to delphic methods—or rely on expert opinion. We do not consider here the issue of whether lack of certainty in calculating damages means damages should go uncompensated but the issue does raise another intriguing issue: who should bear the risk of uncertainty in estimating damages.

68. It is interesting to note that under uncertainty, decision rules incorporate the variance of the distribution of the data *if the decision maker is not risk neutral*. Otherwise, decisions are based on the expected value of the payoffs. Is there any reason to believe the parties causing harm are not risk neutral?

Bayes' Rule to obtain a posterior distribution. This distribution will have a smaller variance than the original distribution and therefore a more precise measure of central tendency. This improves the decision process.<sup>69</sup>

To argue against the use of CVM data is to adopt the position embodied by those who accepted the policy implications of the theory of second best: absent *perfect* information concerning the magnitude of the cross-partials, the optimal policy response is to do nothing.<sup>70</sup> Conventional wisdom aside, this is too extreme in our view. While perfect information is rarely available, we typically have some information; and it is an anathema to economics that such information has no value. This is the point raised by Yew Kwang Ng,<sup>71</sup> who demonstrated that the null policy response implied by the theory of second best would be inferior to doing something when the policy maker has some information.

Absent compelling theoretical arguments to the contrary, the burden is to demonstrate that the information provided by CVM has absolutely no value. Further, the errors resulting from the assignment of compensable damages must be demonstrated to cost society more than the errors of letting those that are responsible be irresponsible. We suggest that a large body of literature demonstrates that CVM provides meaningful results.

## CONCLUSIONS

There are two grounds from which one may criticize a valuation technique: the theoretical basis is flawed or non-existent, and that the empirical estimates lack the necessary robustness for their intended purpose.

Critics of CVM base their critique on appeals to a perceived conventional wisdom, questions concerning the relevance of comparable institutions, and a close examination of existing studies. However, although CVM is not above concern, research suggests that the values obtained via CVM reasonably reflect actual resource costs. Therefore, the glass is half full because valuable information is available for the awarding of compensable damages. As such, the appropriate reaction to concerns regarding CVM-elicited values is additional research involving both field and laboratory investigations.

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69. The larger the variance the more likely we are to commit Type I errors, incorrectly rejecting a null hypothesis concerning the value of the environmental damages.

70. R. Lipsey & K. Lancaster, *The General Theory of Second Best*, 24 *Rev. Econ. Stud.* 11 (1956-58) are generally credited with the development of the formal representation of the theory of second best.

71. Y. Kwang-Ng, *Welfare Economics: Introduction and Development of Basic Concepts* (1979) presents this argument in considerable detail.

We find no theoretical or philosophical arguments that establish that the CVM lacks a theoretical basis, except for appeals to a need for a "theory of hypothetical behavior". This is an inappropriate appeal, since CVM is anchored in a theory of contingent claims markets, and the roots of this approach may be found in accepted theory. On these bases, we argue that CVM derives from the same theoretical foundations as neoclassical value theory.

Similarly, we have no empirical basis to reject the use of CVM for compensable damages. We find that where comparisons with other measurement techniques exist, CVM yields sufficiently robust information to warrant its use in a court setting.

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