ISSN 1045-6333

CONTINGENT VALUATION OF THE NONUSE VALUE OF NATURAL RESOURCES: IMPLICATIONS FOR PUBLIC POLICY AND THE LIABILITY SYSTEM

Steven Shavell

Discussion Paper No. 109

5/92

Program in Law and Economics
Harvard Law School
Cambridge, MA 02138

The Program in Law and Economics is supported by a grant from the John M. Olin Foundation.

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Steven Shavell
Harvard Law School, Cambridge, MA 02138

Summary

This paper assesses the likely consequences for public policy and the performance of our liability system of employing the contingent valuation method to attempt to measure the "nonuse" values of natural resources. After reviewing the history of contingent valuation and criticism of it, the paper identifies one potential advantage and three disadvantages of applying contingent valuation in public decisionmaking and liability assessment.

A potential advantage: better public decisions and behavior of firms. In particular, if contingent valuation could provide a *perfect* measure of nonuse values, regulatory decisions and liability-influenced behavior of firms would fully reflect the value of natural resources. For instance, an animal's habitat might be saved just because the full value of the animal would be taken into account by a regulator, or a firm might be led to take a precaution that it would not have found worthwhile if its possible liability had not included the full amount of harm. Such benefits are distinctly potential, however, since in practice contingent valuation provides only an *imperfect* measure of nonuse values.

A disadvantage: bias in estimation may lead to worse decisions and behavior. Bias in contingent valuation estimates is a real possibility, and can distort public decisions, the incentives of firms subject to liability, and product prices. If estimates of valuation are too high, regulation may be too stringent; firms may take unnecessary defensive precautions or decide to withdraw from lines of activity (such as transporting oil) that are on balance socially desirable; and product prices will tend to exceed the true social costs of production, undesirably discouraging purchases.

A second disadvantage: imposition of risk. Use of contingent valuation estimates would be likely to introduce a substantial new risk into the general regulatory and liability environment, leading for another reason to firms' taking unnecessary defensive precautions, to their withdrawal from valuable lines of activity, and to increased product prices.

A third disadvantage: contingent valuation is expensive and would increase the volume and cost of litigation. Contingent valuation is expensive to perform, since it is based on surveys. Moreover (and probably of greater importance), its use in attempting to assess nonuse values could lead to a significant increase in the number of claims because the potential stakes would rise. The increase in the potential stakes would also result in higher litigation expenditures per case.

Conclusion: contingent valuation should not be employed because the disadvantages of using it outweigh the potential advantage. The paper comes to the judgment that the three disadvantages outweigh the possible advantage of contingent valuation, so that it should not be applied in public decisionmaking or liability assessment. This judgment is based in part on consideration of criticisms of contingent valuation, which suggest that contingent valuation estimates may well be biased and are subject to extreme unpredictability.

The law of tort liability is generally consistent with this conclusion: uncertain, subjective components of loss are frequently excluded from damages. The conclusion of the paper is broadly consistent with our law of torts. The legal system traditionally excludes components of loss from tort damages if these components are too difficult to estimate -- even though these components are often positive. For example, an individual cannot ordinarily collect for the nonpecuniary losses suffered due to the death of a close friend.

Contingent Valuation of the Nonuse Value of Natural Resources: Implications for Public Policy and the Liability System

Steven Shavell[*]
Harvard Law School, Cambridge, MA 02138

The goal of this paper is to examine the potential advantages and disadvantages of employing the contingent valuation method to attempt to measure the "nonuse" values of natural resources, and the harm to these resources, for purposes of public decisionmaking and the assessment of liability. The nonuse values of natural resources include the worth of these resources to future generations as well as the utility of the mere existence of the resources to individuals (even if they never see or experience the resources in any immediate way).[1]

To this end, I will first sketch the history and evolution of contingent valuation. This will bring us to the present, when we find that contingent valuation is both increasingly considered for practical application and increasingly criticized as a way of estimating the nonuse values of natural resources. I will next describe major criticisms of contingent valuation; these have principally to do with claims that contingent valuation is unreliable or lacks meaning and produces highly variable estimates of nonuse values. Then, in the third section of the paper, I will analyze the general consequences of employing possibly inaccurate and uncertain measures of valuation in public decisionmaking and in liability assessment. Here it will be emphasized that bias and uncertainty in estimation may lead to regulatory error, socially undesirable reactions from potentially

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[*]This paper reports on research funded by Exxon Company, U.S.A. The results reflect the opinions of the author and not necessarily those of Exxon.

[1]Krutilla [1967] contains an early discussion of the existence value of natural resources.

liable firms (including their withdrawal from socially desirable activities), as well as an increase in the volume and cost of litigation.

Based on this analysis and my understanding of the state of the art of contingent valuation, I will conclude in the fourth section that contingent valuation should not now be used to attempt to measure nonuse values of natural resources either in public decisionmaking or in liability assessment. In these contexts, society is likely to be better off not seeking to estimate nonuse values with contingent valuation because of the serious problems that this would engender. In the last section of the paper, I offer several comments about this conclusion.

1. History and Evolution of Contingent Valuation

The term "contingent valuation" refers to estimation of the value of something to a person by asking him a hypothetical question about its value. A person might be asked, for instance, how much he would pay to save the life of a dog which he is to suppose would otherwise be put to sleep. The adjective "contingent" is descriptive of this methodology because the valuation is contingent on an imagined rather than a real situation (the person does not actually pay money, nor does he actually save a dog's life).

Academic interest in contingent valuation emerged among economists in the early 1960's due to their desire to measure the use-related worth of unpriced natural resources. The first contingent valuation study was apparently Davis [1963a,b], who attempted to measure the recreational value of an area of the Maine woods to hunters and other users; other early studies were similarly concerned with the recreational value of natural

resources.[2] Work on contingent valuation proceeded fairly rapidly and, by the 1990s, contingent valuation studies have been published about a diverse range of natural resources, as well as about many other things of value, for example, decreased mortality risk and increased support for the arts.[3] In addition, much has been written about contingent valuation as a methodology: on the theory underlying it, on survey design, and on statistical technique. With hundreds of articles having been published on contingent valuation, the literature on the subject is now substantial.[4]

Interest in contingent valuation has not been confined to academia, however. The technique has begun to be applied in public decisionmaking. The U.S. Army Corps of Engineers, for instance, has employed contingent valuation to measure the benefits of contemplated water resources projects.[5] Also, it appears possible that public utility regulators will want to turn to contingent valuation to measure environmental harms, for they are increasingly required to consider such harms explicitly in the utility planning process.[6]

Contingent valuation has also begun to enter into natural resources litigation, principally in connection with assessment of harm. For example, in a recent case involving the death of fish caused by the spill of a toxic chemical in a river, contingent valuation was offered by plaintiffs as a way of

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[2]See, for example, Cicchetti and Smith [1973], Darling [1973], and Hammack and Brown [1974].

[3]See Appendix A, pp. 307-315, of Mitchell and Carson [1989] for an extensive list of types of contingent valuation studies.

[4]See the survey in Mitchell and Carson [1989], especially at pp. 9-14; and see the bibliography in their book.

[5]See p. 13 of Mitchell and Carson [1989].

[6]See Palmer and Krupnick [1991].

measuring the existence value of the fish.[7]

The idea of employing contingent valuation to estimate harm to natural resources has been stimulated in part by a decision of the U.S. Court of Appeals for the D.C. Circuit in *State of Ohio v. U.S. Department of the Interior*, 880 F.2d 432 (D.C. Cir. 1989). This decision encourages the measurement of the full harm to natural resources, including nonuse components, assuming that nonuse value can be reliably determined. The decision must be taken into account and interpreted by federal agencies in devising regulations for measuring damages to natural resources under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Clean Water Act of 1972 (CWA), and the Oil Pollution Act of 1990 (OPA).

Moreover, it would be in the spirit of using contingent valuation for estimating harm to natural resources to apply contingent valuation also to ascertain whether a party who caused harm to natural resources was liable for negligence (where liability is based on negligence rather than strict liability). This is because the negligence determination requires an assessment of the magnitude of possible harm.[8]

Another possible use of contingent valuation is to aid in

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[7]See *Idaho v. Southern Refrigerated Transport Inc., et al.*, No. 88-1279 (D. Idaho). In this case, a truck overturned and spilled a fungicide into the Little Salmon River, killing an estimated 43,835 fish. The state of Idaho requested that the court consider the commercial, recreational, and existence value of the fish. The existence value claim was based on a contingent valuation study. (As it turned out, the court rejected the claim saying that "it would be conjecture and speculation to allow damages based on this study.")

[8]Specifically, a party is negligent if his actual precautions fall short of the proper level, but this proper level of precautions depends on the magnitude of the potential harm. For instance, it would be negligent to fish using a method that will result in the death of dolphins if the value of dolphins is sufficiently high. Accordingly, if contingent valuation is used to measure the value of dolphins and if the resulting value is sufficiently high, contingent valuation will have been used to conclude that there was negligence, not just to determine the level of damages to be paid.

calculating the degree of cleanup required of a party responsible for harm to a natural resource. This is because the value of the resource will affect the amount that is rational to spend on cleanup.[9] Thus, the possible applications of contingent valuation in the context of natural resources litigation are not limited to damage assessment, even though that seems to be the most prominent domain of use now contemplated.

Finally, it is relevant to observe that contingent valuation could be used in litigation outside the area of natural resources. One can imagine that litigants could use contingent valuation estimates for evaluation of pain and suffering or for loss of consortium. One can even envision the use of contingent valuation to estimate the existence value to our citizens of those who die in an airplane crash, or the discomfort felt by the populus when someone has been denied his or her civil rights. Evidently, the conceivable range of applications of contingent valuation in litigation is broad.[10] Likewise, the scope for use of contingent valuation in public decisionmaking seems great in principle; there is no apparent reason for it to be considered only for valuing natural resources.[11]

As contingent valuation has become more important both in fact and in its potential application, it has as well become the object of greater scrutiny and criticism. It is to this that I will now turn, so that I can later address the possible problems of using contingent valuation in public decisionmaking and liability assessment.

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[9]See NOAA [1990].

[10]As I will discuss below (see Section 3(f)), however, the present state of tort law probably would not favor use of contingent valuation.

[11]A similar theme is discussed in Rosenthal and Nelson [1992] (who view the expansiveness of the concept of existence value as problematic) and by Kopp [1992] (who does not).

2. Criticism of Contingent Valuation

Criticism of contingent valuation may be divided into six claims: that individuals sometimes do not have adequate understanding of what they are being asked to evaluate; that they may have motives to misrepresent their opinions; that they may have poor incentives to answer questions carefully; that their answers may reflect something different from valuation; that their answers may depend substantially on the form in which questions are posed; that in fact contingent valuation estimates have been highly variable. I will now amplify these types of criticism in the context of contingent valuation of natural resources. It will not be my purpose to attempt to prove that the criticisms are correct, but rather to explore their plausibility so that I can better evaluate (in Sections 3 and 4) the implications of using contingent valuation.

(a) *Individuals may not be able to estimate or even to understand the values or harms about which they are asked.* In certain contexts, individuals need a great deal of data and scientific, economic, or other specialized knowledge to be able to estimate the values or harms about which they are asked.

If, for instance, people are to evaluate the consequences of an oil spill, they must have adequate information about the harm done by a spill and the persistence of its effects. If people do not have good statistical information about animal populations and ecology, it will be difficult for them to determine the harm to natural resources due to an oil spill. If, for example, they think that a species is rare or even threatened with extinction when in fact it is not, they will overestimate the harm imposed. If tourism is disturbed by an oil spill and people think that tourism is more important to the local economy than it is in

fact, then people will overestimate the harm due to the spill. Or if people have the grossly incorrect impression that an oil spill is as long-lasting in its consequences as would be the leakage of radioactive material with a 100 year half-life, they will greatly overestimate losses due to a spill.[12]

In reality, people arguably have relatively little of the knowledge that would be needed to evaluate the effects of many, if not most, types of harm to natural resources. Casual observation suggests that people have only a meager appreciation of the effects of such events as oil spills, of the ecology of natural resources and animal behavior, and of the economic consequences of harm to natural resources.[13]

To some degree, this problem of lack of knowledge can be ameliorated by providing information to individuals questioned in a contingent valuation survey. However, our practical ability to communicate information to individuals is limited. The average person's capacity to understand statistics, the ecological significance of natural resources, and so forth, is circumscribed, as is the time and attention that he or she would

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[12]Consider another example. Suppose that people are asked about the benefits and costs of preserving the habitat of an animal (such as a species of owl) in some region. To evaluate the benefits of preservation, they would have to understand how many habitats exist for the animal elsewhere in the country, the role the particular animal plays in the local ecology, how many people actually see the animal, and the like. To evaluate the costs of preserving the local habitat, they might have to be able to determine the number of homes that would have been built in the habitat, or the number of jobs that would be lost because the habitat could not be used for business purposes (like logging) and what the consequences of the job losses would be.

[13]For example, in a recent article, "Environment: EPA, Public Differ Over Major Risks" in the *Wall Street Journal* (page B1, 10/1/90) by David Stipp, a survey of public opinion about environmental risk was compared to an expert evaluation of risk by the Environmental Protection Agency (EPA). Public opinion and the EPA assessment of risk contrasted greatly. The survey indicated that Americans rank the country's top four environmental problems as water pollution from manufacturing plants, oil spills, hazardous waste releases, and industrial air pollution. The EPA, however, ranked oil spills and water pollution as relatively low risk problems, whereas they said the four most serious problems are climatic change, habitat destruction, species extinction, and ozone layer depletion.

be expected to devote to the task.

To this point, I have been discussing the problem that people frequently lack the knowledge needed to estimate value or harm. But sometimes a different problem exists: people may be conceptually confused about the question posed to them.[14] In particular, consider the existence value of a natural resource. If someone is asked about the value of the mere existence of a natural resource, such as a beach in the area, would the person understand that this component of value is distinct from the value he attributes to his own use or other peoples' use of the beach?[15] Introspection makes one skeptical of the proposition that most people comprehend well the nature of existence value, and one can hardly blame them, given the difficulty of the mental experiment that they must perform to determine it.[16]

(b) Individuals may misrepresent their beliefs. Individuals may benefit from supplying answers that are different from their actual evaluations. Individuals may believe (correctly or not) that contingent valuation results will influence public or private decisions in some manner. In that case, it could be that

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[14]See Schkade and Payne [1992].

[15]It is occasionally said that the inability of a person to separate existence value from other values is not problematic, for the person can be asked to supply total value. But if a person is incapable of separating the two components of value, it may often, if not typically, be the case that the person does not really understand the nature of the total value that he is being asked to supply.

[16]Another example illustrating the conceptual complexities bound up in the notion of existence value may be worth mentioning. Suppose that 1,000 birds die in some area. How would a person take the following possibility into account? The death of the 1,000 birds may mean that there will be enough food and nesting area available for the bird population rapidly to replenish itself; and after several years, there may again be 1,000 birds living in the area. If what the person cares about is that *some* 1,000 birds live in the area, and not *which* birds live there, he should properly say that the loss of existence value due to the death of the 1,000 birds is negligible when the bird population quickly restores itself. A related issue that the person must consider is that if the bird population does not restore itself, some other animal population may grow in size. Will the person's existence value increase for this reason? These questions may appear to involve fine philosophical issues, but a person must have clear answers to them to answer basic questions about existence value.

they would want to exaggerate their valuations to increase the apparent importance of a natural resource, or it could be that they would want to supply lower than honest answers to diminish its apparent importance.[17]

Although individuals may thus benefit from misrepresenting their true beliefs, they do not bear any obvious penalty for so doing. Accordingly, we would expect them often to supply answers that deviate from their opinions.[18] Suggestive evidence in this regard includes the frequency of outliers (very high numbers) in contingent valuation data, and the difference between contingent valuation estimates of the value of natural resources and actual giving for preservation of natural resources.[19,20]

(c) Individuals may lack incentives to answer carefully. To answer questions about valuation of a natural resource will often require that an individual make a substantial conscious effort to consider what he knows about the resource as well as alternative

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[17]It is true that the effect of misrepresenting one's evaluation on survey statistics will typically be small. But, as I am about to note, there are no apparent costs associated with doing so.

[18]It is sometimes suggested (see, for example, pp. 233-238 of Hoehn and Randall [1987] and, more generally, pp. 127-170 of Mitchell and Carson [1989]) that the misrepresentation problem can be overcome. The theoretical arguments supporting this position rest on two assumptions: individuals answer as if they believe that they will *actually have to pay* for a resource if a social authority decides to obtain it; the amount a person actually will have to pay will be larger the larger is his announced valuation. Given these two assumptions, a rational person should be dissuaded from misrepresenting his valuation. For instance, he will not exaggerate his valuation of a resource -- because he is presumed to believe that he might have to pay more for it than its true worth to him as a consequence. But this logic seems strange because it relies on the assumption that people answer as if they believe that they will actually have to make a payment. This assumption contradicts the very essence of contingent valuation: that it is hypothetical. One supposes that people who answer contingent valuation questions do *not* believe that they will have to make payments as a consequence of their answers.

[19]For a discussion of the evidence on misrepresentation of valuation, see section IV of Diamond and Hausman [1992].

[20]Note that the point of this subsection is independent of that of subsection (a). A person could have the information necessary to make an accurate evaluation yet distort his evaluation.

uses of his income. For example, in order to estimate the value of a bald eagle, the person should consider a single eagle in relation to the bald eagle population in the country (or possibly in the world), the bald eagle species in relation to all other species of birds, birds in relation to all other forms of animal life, and so on. The individual should consider also how much he spends of his income on things other than natural resources. The effort it will take to make such comparisons and judgments is not trivial, especially because most individuals will not have had experience making actual expenditures on natural resources.

Yet, again, individuals will suffer no penalty from giving incorrect answers. Hence, their answers are unlikely to be carefully considered and thus will often be inaccurate for a reason different from those already suggested.[21]

(d) *Individuals may supply answers that reflect factors other than their valuations.* It appears that factors different from their valuation of a natural resource may influence individuals' answers to contingent valuation questions. One possibility is that a person may supply an answer to please the interviewer or to avoid the appearance of stinginess. Another is that a person may obtain a utility benefit from the opportunity to express his point of view -- in the form of his answer to a contingent valuation question -- about an issue of importance to him that is suggested by a contingent valuation question. Suppose that a contingent valuation question is regarded as an occasion to express disapproval of big business; then one might expect the person to report a high number for the valuation of a

[21]The problem discussed in this subsection is logically distinct from the problem emphasized in subsection (a), that individuals may lack the information necessary to determine valuation, as the point here is that even if individuals have the information they need to make an evaluation, they must still consider it with care and organize it meaningfully in order to arrive at a proper estimate. Also, it is clear that the point made here is different from the point of subsection (b), as the present point has nothing to do with an individual's desire to misrepresent his opinions.

natural resource as if to punish big business. Or suppose that a contingent valuation question about saving the lives of some type of bird is associated in a person's mind with protection of wildlife in general, which he feels to be a worthy goal. Then by supplying a positive answer to the valuation question, the person may experience a feeling of virtue, a "warm glow", similar to that from giving to a charity; and the magnitude of his answer may not bear any clear connection to his valuation of the particular birds, or their number, mentioned in the question actually put to him. Indeed, such a hypothesis is consistent with recent evidence that contingent valuation responses may be approximately the same for very different quantities of natural resources.[22]

(e) *Contingent valuation responses may depend significantly on how questions are posed.* Intuition and what has been discussed in subsections (a)-(d) suggest that significant differences in response about valuation may result from altering the form in which questions are asked.

First (referring to (a)), a question can include or fail to include relevant information. A question about oil spills could include information about how quickly oil tends to dissipate or not include that information. Obviously, this could affect the response of people, presuming that they do not have the information in the first place.

Second (referring to (b)), the form of a question can affect the incentive of an individual to distort the truth. For instance, if it is suggested that the contingent valuation data will influence policy makers, people may answer differently from otherwise.

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[22]See Kahneman and Knetsch [1992], Desvouges, et al [1992], and Diamond, et al [1992].

Third (referring to (c)), the form of a question can affect the ability of a person to relate one natural resource value properly to other natural resource values and to values from other uses of his wealth. For instance, recent evidence suggests that if in a contingent valuation study one just asks for an estimate of the value of an animal, a much larger number will be obtained than that from a sequence of valuation questions designed to force a person to compare different types of expenditures he might make.[23] In any event, the point is again that the way in which questions are posed probably will significantly affect the responses that individuals provide.

Fourth (referring to (d)), if in a question the harm to the environment is said to be due to the fault of a large company (rather than, say, to an act of nature, such as a storm or a volcano), then individuals may view the question as a chance to express general disapproval of big business.

In addition, there are other factors that apparently can influence contingent valuation results. One of note is that if people are simply asked to supply an evaluation, they will offer different answers from the ones obtained if they are asked questions which give them some numerical guidance (questions of the form, "Would you be willing to pay at least this much?" or "Would your willingness to pay be less than this amount?).[24]

(f) *Variability in past contingent valuation estimates.* It

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[23]See Kemp and Maxwell [1992]. The spirit of their "top-down" sequences of questions is illustrated by the following: an individual is first asked how much of his income he would devote to expenditures other than personal consumption; then about the percentage of this amount that he would devote to the environment (as opposed to the homeless, the arts, religious causes, and so forth); then about the percentage of this that he would devote to preservation of animals (rather than plants, inanimate entities);...; and the percentage of this that he would devote to an animal of the species of concern. Multiplying the first amount by all the percentages, one would arrive at the person's valuation for the animal.

[24]See, for example, McFadden, et al [1992].

is consistent with the criticisms, and especially with the points just made in subsection (e) about the influence of the design of contingent valuation questions on reported values, that contingent valuation results will vary from one survey to another. There is evidence that this is indeed the case. For example, three studies attempting to measure the value of improving visibility at the Grand Canyon (by reducing sulfur dioxide emissions at a nearby power plant) yielded the following three figures:[25] $9.5 *billion* per year;[26] $2.4 to $3 billion per year;[27] and $2 *million* to $50 million per year.[28]

The conclusion that I draw from this review of criticism is that contingent valuation may well produce statistics that have no clear meaning, that reflect factors different from valuation, and that are peculiarly affected by survey design and vulnerable to manipulation. In light of this, it is important to inquire about the general effects of use of possibly biased and highly variable estimates of valuation on the functioning of the public decisionmaking process and the litigation system.

3. Public Decisionmaking and Liability Assessment with a Method Producing Inaccurate and Highly Variable Estimates of Value: General Analysis

As just stated, the issue under consideration here is the consequences of using a method of estimation of value that is potentially biased and highly variable, in the context of public

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[25]These figures are based on extrapolations from the reports cited in the next three footnotes.

[26]See Schulze, Brookshire, Walther, and Kelley [1981].

[27]See Rowe, Chestnut, and Skumanich [1990].

[28]See Carson [1991].

decisionmaking and liability assessment.

By public decisionmaking, I mean, of course, determinations of whether to carry out public projects or to regulate activities. Examples are whether to build a dam that might flood the natural habitat of an animal, or whether to require that certain chemicals not be used because of danger to the environment.

And by liability assessment, I mean the measurement of harm for the purpose of imposing liability on a party found legally responsible for it.

I will assume that there are two components of value: an easily-measured component, and a component which can be estimated only by using a method that is subject to potentially large error. I make this assumption because in the context of natural resources, as in many others, there are some components of value which can fairly readily be measured using market data (such as the commercial value of fish), together with components that cannot easily be measured (such as certain nonuse values).

Should public decisionmaking and liability assessment be based on both the easily-measured component of value and on an estimate of the other, hard-to-measure component? The instinctive answer might be that, yes, the estimate of the second component should be used, for, after all, some information is better than none about a component of value. But this answer is not necessarily correct. Bias in the estimate of the second component may lead to incorrect regulation and adversely affect both the behavior of potentially liable parties and product prices. In addition, use of the estimate will introduce a new source of risk into decisionmaking and litigation, with undesirable consequences. Moreover, use of the estimate will involve measurement costs and may increase litigation expenses.

These factors imply that, under many circumstances, it is best not to include the estimate of the hard-to-measure component of value.[29] Let me now elaborate this argument.

(a) *Potential benefit from including the estimate of the hard-to-measure component: better decisions and behavior.* The potential advantage of including the estimate is that if it were a *perfect* estimate of the hard-to-measure component, then regulatory decisions and liability-induced behavior, as well as product prices, would fully reflect values and costs. The benefit from including the hard-to-measure component might be that an animal's habitat is saved just because the full value of the animal is taken into account. Or the benefit from including the component might be that a firm is led to take a precaution that it would not have found worthwhile if its possible liability had not included the full amount of harm. Or the benefit might be that the firm's product price is higher due to its larger liability bill, leading some consumers not to purchase the product -- those who are not willing to pay the price that correctly reflects the full amount of harm associated with production.

These benefits are the benefits of including a perfect estimate of the hard-to-measure component. Since the actual estimate is assumed to be *imperfect*, however, the benefits of including this estimate will be lower, if they even exist.

It is important to recognize also that the potential benefits of including the estimate depend on the true magnitude of the hard-to-measure component. If the component is usually small, then excluding it will often not result in an incorrect public decision, incorrect deterrence of firms, or incorrect

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[29]But the hard-to-measure component of value could still be reflected in an appropriate way in statutes and regulations; see the remarks in Section 5.

purchasing decisions by consumers. Moreover, if in this case an incorrect outcome occurs because the component is excluded, the error will not be very costly for society, since by hypothesis the excluded component is small.

(b) *Potential disadvantage of including the estimate of the hard-to-measure component: bias in the estimate may lead to worse decisions and behavior.* A potential disadvantage of including the estimate arises if the estimate is biased. When that is true, the inclusion of the estimate can distort public decisions, the incentives of parties subject to liability, and prices. If the estimate is higher than the true value of the component, then, for example, regulation may be too stringent. Also, because of their fear of excessive liability, companies may take unnecessary defensive precautions, or decide to withdraw from lines of activity (such as transporting oil) that are on balance socially desirable. It is possible as well that companies would be driven into bankruptcy, with attendant social costs.[30] Moreover, product prices will tend to exceed the true social costs of production, undesirably discouraging purchases.[31]

These problems could be worse than the problem due to exclusion of the hard-to-measure component. That would be particularly the case if the bias in the estimate were large in relation to the true magnitude of the hard-to-measure component.

(c) *Disadvantage of including the estimate of the hard-to-measure component: imposition of risk.* To the degree

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[30]These include legal and other transactions costs of the bankruptcy process itself, coupled with costs due to the cessation or interruption of a company's business operations.

[31]For example, if the price of oil increased from its true social cost of, say, $20 per barrel to $40, a factory might switch to an alternative fuel, such as coal, at a cost of, say, $25 for an amount equivalent to a barrel of oil. Such a change would be socially undesirable, since society would needlessly be devoting more of its resources to operate the factory (for every barrel of oil thefactory had purchased, it would now be spending $5 more on coal).

that there is risk attaching to the estimate of the hard-to-measure component, use of the estimate will introduce a new risk into the general regulatory and liability environment.[32] Because a very high estimate of the component might be employed, regulatory compliance might become very expensive, as might the liability of a party.

The undesirable consequences of the imposition of large risks are similar to those just mentioned due to bias: the taking of excessive precautions and withdrawal from socially valuable lines of activity. This is true because corporate decisionmakers will want to guard against large risks.[33] In addition, the presence of risk brings with it the potential for bankruptcy and higher product prices.

(d) *Disadvantage of including the estimate of the hard-to-measure component: costs of generating the estimate, a greater volume of litigation, and increased litigation expenditures.* Another disadvantage of including the estimate of the hard-to-measure component is the cost of deriving the estimate, which may be significant. Furthermore, there often will be different parties who have opposing interests in a public decision; and this will by definition be the case in the litigation context. Hence, government agencies may finance or require multiple estimates, and different private parties may independently generate their own estimates. This will enlarge the costs of including the estimates.

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[32]This risk is distinct from the risk that losses themselves can vary from one situation to another.

[33]As both casual observation and the theory of agency suggest, corporate decisionmakers will generally work under salary and reward schemes that are linked to some extent to corporate profits (so that they will have an incentive to increase corporate profits). But this also means that the decisionmakers will be exposed to risk and therefore will try to avoid it.

There are several additional (and perhaps more significant) cost-related disadvantages of including an estimate of the hard-to-measure component. One is that there may be an increase in the volume of litigation, as the potential gains for plaintiffs will include the estimate of the hard-to-measure component. Second, there may be an increase in the frequency of trial rather than settlement. For with the estimated value of the component included, there will be a new issue about which the parties might disagree, and thus another possible hindrance to settlement. An offsetting factor, however, is that the increased risk of litigation may promote settlement. Third, parties will tend to spend more, whether in reaching settlement or in litigation, since the stakes will be higher.

All of these costs, it should be emphasized, are socially wasteful; they absorb time and effort and other resources that could be productively employed elsewhere.

(e) *Conclusion: if the several disadvantages of including the estimate of the hard-to-measure component outweigh the potential advantage, then the estimate should not be included.* To put this point differently, *using an imperfect estimate of the hard-to-measure component of value may well be worse than excluding the component.* It follows from what has been said that it is better to exclude the estimate, everything else equal, the smaller the true magnitude of the hard-to-measure component, the larger the bias or risk in the estimate, and the greater the costs associated with using the estimate.

(f) *The actual law of damages for torts is generally consistent with this conclusion: uncertain, subjective components of loss frequently are excluded from damages.* Not only does the conclusion of the last paragraph make sense in theory, it is broadly consistent with our law of torts (civil liability for causing harm). The legal system traditionally excludes

components of loss from tort damages if these components are too difficult to estimate -- even though these components are often positive.[34] For example, individuals cannot collect for the nonpecuniary losses they suffer due to the death of others except under restricted circumstances (including that they have a close family relationship to the deceased); and individuals' ability to collect for the nonpecuniary losses they suffer due to the death of pets is circumscribed.

The reasons for our legal policy are, I suspect, that inclusion of speculative elements of loss would be costly, increase the volume of litigation, and generate unnecessary and detrimental risk, whereas exclusion does not much harm incentives when the true elements of loss are not very large.

4. Application of the Foregoing to Contingent Valuation

It is likely that contingent valuation has the general properties discussed in the preceding section that would make it inappropriate to apply to estimate nonuse losses or nonuse values of natural resources.

First, the true magnitude of nonuse value is arguably small in many instances. I will illustrate by reference to the nonuse value of a common seabird, say a gull. Consider a household with annual disposable income of $25,000. It is quite plausible that the household would choose to spend all but $1,000 on personal expenditures. Of this $1,000, let us suppose that $700 would be devoted to charities and other causes unrelated to the environment, so $300 would be left to be allocated to the environment. Now it might be reasonable to assume that of this $300, $10 would be devoted to preserving birdlife. Next, assume

[34]For this principle in tort law, see, for example, §§9.8 and 9.10 of Fleming [1983]. Similar principles govern calculation of damages in contract law and other areas of law.

that of this $10, 1% would be for gulls (there are a multitude of species of birds), so the value of all gulls to the individual would be $.10. Suppose too that the nonuse value of the present generation of gulls is 10% of the nonuse value of all generations of gulls, making the nonuse value of the present generation of gulls $.01 to the household. Suppose further that there are 10 million gulls in the United States, so that the nonuse value per gull per household would be about $.000000001. Multiplying by the number of households in the country, roughly 100 million, one obtains approximately $.10 for the existence value of a gull for the country.[35] This type of logic suggests that the nonuse value of many natural resources is low, although I am of course not claiming that all natural resources have low nonuse values.

In addition, the amount that people actually give to preserve natural resources and the environment generally -- as well as for care of the homeless and other forms of aid for humans (as opposed to natural resources) -- is not large.[36] Moreover, the amount people give when asked may often reflect more than their valuations, such as pressure to give, a desire to please the person making the request, or a desire to express one's beliefs about the environment. All this suggests that the nonuse values people place on particular natural resources frequently are small.

A second reason contingent valuation has the general properties discussed in the previous section is that contingent

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[35]It is interesting -- and revealing -- to contrast this value of *one dime* for a gull to the value on the order of *$100,000 per seabird* implied by a recent contingent valuation survey conducted after the *Nestucca* oil spill; see Rowe, Schulze, Shaw, Schenk, and Chestnut [1991]. This survey yielded a low estimate of $65 per (state of Washington) household as the value of harm due to a hypothetical oil spill for which the major effect was the death of approximately 40,000 common seabirds. If the $65 figure is taken as the existence value of 40,000 seabirds to the average U.S. household, then the value of a single seabird for 100 million households is $162,500.

[36]For example, total contributions to all environmental and wildlife causes in 1990 was only about $2.3 billion; see AAFRC [1991].

valuation estimates may often be biased. As discussed in Section 2, if people misperceive the nature of environmental harm, misrepresent their beliefs, fail to consider carefully how much of their income they would really be able to devote to natural resources, or view contingent valuation surveys as opportunities to express their opinions, biases in the value of natural resources will be produced.

The possibility of significant bias seems great. In fact, it is easy to imagine that a contingent valuation study of virtually *any* harm to natural resources could be estimated to be in the billions of dollars. To illustrate, suppose that 100 dolphins die during fishing operations (say they are caught in nets). One can well envisage the nonuse value of a dolphin to the average individual surveyed in a contingent valuation study to be "conservatively" estimated as ten cents, making the nonuse value of the 100 dolphins, when summed over the 260 million people in the United States, about $2.6 billion.[37] It is worthwhile emphasizing the meaning of this figure. Its implication is that companies might be led to spend enormous sums, up to $2.6 billion, to avoid killing 100 dolphins.

Third, contingent valuation estimates are highly variable. An example of variability in contingent valuation was noted above in reference to studies of the value of visibility in the Grand Canyon. Indeed, the risk associated with contingent valuation seems extraordinary, as the example of the 100 dolphins indicates.

Fourth, contingent valuation is costly to apply because of the expense of carrying out surveys and because it would be

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[37]To the reader who doubts that this figure misrepresents social value, I ask the following question: Were society really to face the choice of spending $2.6 billion either on saving 100 dolphins from death, or on $1,000 worth of food and shelter for each of 2.6 million homeless individuals ($1,000 x 2.6 million = $2.6 billion), which would it clearly choose?

likely to lead to a greater volume of litigation and higher litigation costs.[38]

These factors suggest that contingent valuation estimates of the nonuse values of natural resources should not be used in public decisionmaking or in liability assessment. If contingent valuation were to be used, then the risks of multibillion dollar liabilities for relatively minor adverse events like the death of 100 dolphins could dramatically and socially undesirably distort the incentives of corporations. Corporations could and probably would be led to make socially excessive expenditures to avoid liability and to abandon lines of business that society values. Product prices would rise substantially above true cost of production, and consumption would be undesirably discouraged.

5. Concluding Comments

The recommendation in this article against using contingent valuation to estimate the nonuse values of natural resources may trouble some readers because this is a recommendation not to employ a methodology to take into account a component of the value of natural resources even though it is appreciated that the component is often positive. I have two final comments to make in response to such a concern.

First, it should not be overlooked that society already recognizes nonuse values of natural resources in significant ways, including establishment of national parks, the granting of

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[38]For example, in the case of the *Exxon Valdez* oil spill, governmental plaintiffs have expended at least $6 million for contingent valuation estimates, as reported in the 1989, 1990, and 1991 versions of the State/Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill. Moreover, one suspects that state and federal government together with Exxon Corporation spent well over a hundred million dollars on litigation concerning the *Exxon Valdez* oil spill before settling; a significant fraction of this amount can probably be attributed to the possibility that damages would be high due to the use of contingent valuation to estimate nonuse losses.

special protections to endangered species, enactment of a substantial body of environmental regulation, and imposition of civil and criminal penalties for various environmental harms. Thus, the recommendation not to employ contingent valuation estimates does not mean that nonuse values are, or will be, ignored in social decisionmaking.

Second, as indicated in the third section of this paper, tort law commonly does exactly what is being recommended here in regard to contingent valuation, when tort law excludes from damages hard-to-measure components of losses (like the suffering of friends of people who die due to someone's negligence). It is plausible that tort law excludes such losses to avoid the problems that would flow from attempting to estimate them, not because they are felt to be nonexistent. For this reason we are not greatly disturbed about the omission of these losses from tort damages. Neither, then, should we be inordinately disturbed about not using contingent valuation in an attempt to measure the nonuse values of natural resources.

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