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Identifying and Measuring Nonuse Values for Natural and Environmental Resources

A Critical Review of the State of the Art



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Identifying and Measuring Nonuse Values for Natural and Environmental Resources

A Critical Review of the State of the Art

Health and Environmental Affairs Department

PUBLICATION NUMBER 316

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Section 1

OVERVIEW AND PURPOSE OF THE STUDY

The purpose of this study is to review the state of the art for identifying nonuse values for natural and environmental resources and for measuring them with the Contingent Valuation Method (CVM). The intent is to move beyond the taxonomic survey of potential biases which is found in a number of existing works such as Cummings, Brookshire and Schulze [1986] and Mitchell and Carson [1989]. We attempt to keep attention sharply focused on a set of basic issues which, in our view, should be at the core of contemporary debate concerning nonuse values and the CVM. These issues are: the theoretical foundation of nonuse values; the conditions under which nonuse values can be measured; the theoretical foundation of the CVM; and the extent to which responses to "willingness to pay" questions posed in applications of the CVM can be interpreted as values that represent a real economic commitment.

To set the stage for our study, we briefly sketch our major conclusions and describe the manner in which the study is organized. We must first, however, provide the reader with an appropriate perspective for the notion of "conventional wisdoms" and their importance for the method of inquiry used in the study, as well as for the manner in which our conclusions regarding nonuse values and the CVM *must* be interpreted.

"Conventional wisdom" refers to knowledge of what is true or right ("wisdom") that is established by convention, general consent, or accepted usage ("conventional").¹

Conventional wisdoms regarding one position or another may be implied by assertions of "fact" ("*this*" is the way it is, or "everyone knows that..."), by references or citations to many people that have accepted the position, or by appeal to substantive evidence which supports the position. Conventional wisdoms may not be correct. They can change when knowledge about what is true or right changes. *Assertions* of conventional wisdom for a position may not be correct in cases where "factual" statements are incorrect, citations of people supporting the position are incorrect (they do *not* support the position), or when evidence posited to support the conventional wisdom is shown to support a contrary position. Appeal to conventional wisdom can be a powerful argumentative tool when it imposes on opposing views the burden of proof that the conventional wisdom is incorrect for one or more of the reasons given above.

¹ *American Heritage Dictionary* [1982; pp. 319, 1386].

A review of the state of the art in a subdiscipline would typically involve the simple process of bringing together the relevant conventional wisdoms. In total, these wisdoms constitute the state of the art. All else equal, such a process would make our task a particularly easy one in the sense that there is certainly no shortage of conventional wisdoms regarding nonuse values and the CVM. As examples, the following exemplify a conventional wisdom concerning the composition of individual values and our knowledge of existence values that are based upon asserted fact and an appeal to substantive evidence:

"...total economic value is made up of five components: (1) onsite recreation use of the resource; (2) commercial use of the resource; (3) an option demand from maintaining the potential to visit the resource in the future; (4) an existence value derived from simply knowing the resource exists in a preserved state; and (5) a bequest value derived by individuals from knowing that future generations will be able to enjoy existence or use of a resource." Loomis, Hanemann and Kanninen [1991; pp. 412-413]

"Contingent valuation studies have also documented considerable willingness to pay for existence. For example, Schulze *et al.* (1983) found that estimates of willingness to pay to preserve visibility at the Grand Canyon were dominated by existence values. Other contingent valuation studies that found a willingness to pay for existence were reported by Brookshire, Eubanks and Randall (1983)." Boyce, Brown, McClelland, Peterson and Schulze [1989; pp. 306-307]

Here is an example of "fact" concerning a strong theoretical foundation underlying the CVM:

"Constructed markets [the CVM] enjoy a very strong theoretical foundation. (...) Constructed markets, in principle and in contrast to other benefit measurement techniques, can directly obtain WTP or WTA." Carson [1991; p. 123]

And here are examples of "facts" related to people's behavior in CVM studies: in offering values for environmental and natural resource goods, people do not behave strategically, they tell the truth.

"... experimental work, such as that reported by Vernon Smith [1980] is of interest. In experimental public goods markets with relatively weak incentives for accurate value revelation, Smith finds that most subjects accurately report their personal (induced) valuations." Randall, Hoehn and Brookshire [1983; p.638]

"... the specter of Samuelson's strategic bias proposition remained as a concern ... until the appearance of Vernon Smith's [1977] report of experimental evidence that further belied the strategic bias proposition." Cummings, Brookshire and Schulze [1986; p.16]

In citing these examples, we do not mean to infer that all researchers concerned with nonuse value and the CVM accept the positions implied by the citations. Many do not and we attempt to draw this distinction in our later discussions. Statements of the type exemplified above are sufficiently common, however, to convey the impression of established conventions or accepted usage -- conventional wisdoms. This may particularly be the case for the unwary reader of the literature.

In any case, a state of the art assessment based upon *these* conventional wisdoms, and we document many related assertions in our study, would likely take the following form.

Existence values "exist," they are measurable, and they are large, relative to any total value. The CVM enjoys a strong theoretical foundation and can be used to measure a broad range of values when implemented carefully. Finally, values derived from the CVM may be generally taken as representing truthfully reported values by participants in CVM studies. Surely, then, a method that enjoys this state of the art can serve as a basis for deriving reasonable values.

But What if the Conventional Wisdoms are Incorrect? Our review of the state of the art for nonuse values and the CVM addresses this question: are the conventional wisdoms regarding nonuse values and the CVM indeed correct? We examine the studies cited as providing evidence that existence values exist and are measurable, the factual basis of claims that the CVM is based upon a strong theoretical foundation; the studies cited as providing evidence that CVM subjects will generally report truthful values, and results from empirical studies regarding the extent to which people will actually pay amounts that they say they will pay in the CVM. Results from these analyses are laid bare for the reader's examination. Effectively, we ask the reader to join us in asking: are these results consistent with the conventional wisdoms for nonuse values and the CVM?

As will become apparent, our reading leads us to conclusions which are in stark contrast with the conventional wisdoms and state of the art characterized above. We hope to make clear, however, that these contrasts are not simply the result of differences in opinion between us and other scholars. They result from simply "listening" to the data that form the substance of the evidentiary pillars which are claimed to support these wisdoms. The reader, of course, will draw his or her own conclusions on this point. We attempt, although not always successfully, to facilitate broad participation in this regard by trying to maintain a level of exposition that

may be accessible to the nontechnical reader.

A final observation may be useful in setting the stage for our study and for providing a context for our conclusions sketched below, particularly as they relate to the CVM. Over the last two decades or so, hundreds of studies have been conducted which make use of the CVM in one form or another.² The qualifying clause "one form or another" is important inasmuch as few if any of these studies are strictly comparable. The researcher's judgment plays a large role in the development and application of a CVM.³ Indeed, Carson and Mitchell [1992; p. 2] describe such judgment as it relates to questionnaire design in the CVM as a form of *art*:

"In any event, reliability and validity are at best relative concepts. A fair assessment of work during the last decade on *all* of the nonmarket valuation techniques is that none of them are (sic) automatically produce reliable and valid answers. A fair amount of *art* is required to assess the value of a natural resource. For hedonic pricing and travel cost analysis, this art comes primarily in the econometric specification; for contingent valuation, it comes largely in the form of question wording. In both cases the problem is that natural resources *do not* and *can not* have a *true* value which is context independent."⁴

Just a *few* examples of the many judgments required of the researcher in applying the CVM are:

- the amount and kinds of information regarding a good which is to be given to subjects.
- the framing of valuation questions.
- pretests of questionnaires and *interpretations* of results.
- the choice of a sample population and the choice of an elicitation mode.
- the treatment of zero and outlier values and the choice of statistical methods.

² The bulk of these studies focus on total, as opposed to nonuse, values.

³ For example, Carson *et al.* [1991; p. 3] argues that "In the course of designing a contingent valuation survey...the researcher inevitably must make and justify a number of design decisions which often have no obviously correct answers."

⁴ Many would argue that econometric specification in the CVM is more an art than a science. As but one example, see Bowker and Stoll [1988]. Without implying our acceptance of the argument, we also note Schulze's [1992] position that seems to argue that some natural resources may have values that *are* independent of context: those for which subjects attitudes are "crystallized."

While there exist works to which one may appeal for guidance in making judgments concerning one aspect of CVM design or another,⁵ there exists no common standard for "good" judgments regarding the many complex and interrelated issues which arise in the preparation and implementation of the CVM. While surveys have long been used to obtain information regarding public opinions and attitudes, there exists no compelling evidence that suggests that standards for survey design that have been developed for these uses are applicable in any comprehensive sense to the uses contemplated by CVM surveys. The difference between CVM surveys, wherein respondents are asked to truthfully reveal a real economic commitment to pay some amount of money, and surveys designed to elicit opinions, is made manifest in Mitchell and Carson's [1989; p. 188] description of the key problem facing the CVM practitioner:

"The key problem facing the designer of a CV study, we saw, is the novelty of valuing a public good, given the respondents' varying degrees of familiarity with the good being valued and how they currently pay for its provision."

Thus, as noted by Hoehn and Randall [1987; p. 241], "Not all CVM applications are created equal and differences among formats are likely to influence CVM performance." The problem noted above is that there exists no common standard that might be used for differentiating between a CVM that is "well-born" and one that is "poorly-born."⁶ One can find fault or point to weakness of one kind or another in virtually *every* CVM that has been conducted. But how important is one weakness or another? What does "important" *mean*? In any broad sense, the state of the art of the CVM is one wherein we cannot respond to these questions.

These questions relate to an issue that we regard as fundamental. To paraphrase Hoehn and Randall [1987], all *issues* regarding the CVM are not born equal. Thus, much has been written concerning biases in CVM value estimates that may be attributable to such things as

⁵ Examples of basic references for questionnaire and survey design include Dillman [1978] [1983] and Schuman and Presser [1981].

⁶ For example, "None of these conclusions say anything about the validity of a particular CV study, of course. The multidimensional character of validity and the absence of a clear-cut criterion against which to compare CV values for public goods means that the validity of individual studies cannot be established in a definitive fashion. Each contingent valuation study should be able to survive scrutiny of its scenario and its estimation procedures for content validity, and should provide evidence for its theoretical validity in the form of either theoretically based regression equations or experimental findings based on split-sample comparisons." (Mitchell and Carson [1989; p. 209]) In these regards, one should note that most published CVM studies do not provide the full range of information required for the comprehensive analyses suggested by Mitchell and Carson [1989].

the choice of a payment vehicle, the specificity of good descriptions, or whether or not a bidding process is used.⁷ We do not deny the importance of these issues. However, there exists a set of issues that are fundamental to the *raison d'être* for the CVM which remain unresolved. Our argument is that the resolution of these issues should receive priority, in terms of our preoccupation with methods development questions, over those associated with survey design.⁸

These considerations are basic to our choice of an approach to the task of reviewing the state of the art for identifying and measuring nonuse and total values for environmental assets. We do not attempt a critical review of every CVM study. Our concern with design issues is generally limited to assessments of the theoretical foundation for WTP questions. Our concern is with what we describe above as fundamental issues that are relevant for *any* application of the CVM. Thus, *any* application of the CVM presupposes some theoretical or conceptual basis for operationally meaningful hypotheses which it is intended to test in one way or another. We then inquire as to the substance of the theoretical foundation which is assumed, implicitly or explicitly, in *all* applications of the CVM. *Any* application of the CVM assumes that the process in which subjects formulate values for a particular good is in some sense cogent and has some logical relationship with a well-defined choice set. Thus, we examine the extent to which these assumptions are supported by empirical evidence. *Any* application of the CVM assumes that subject responses reflect a *real economic commitment*, that CVM "values" will reasonably⁹ approximate amounts that people will actually pay for a good. We inquire as to the extent to which empirical evidence supports these assumptions.

The conclusions that we draw are described in a general fashion as follows. In the main, we conclude that existing conventional wisdoms concerning separable nonuse values of an individual are simply incorrect. A conceptual basis for total values of a nonuser can be justified, as can use and nonuse values of a user. In terms of use and nonuse values of a user, we know of no practical means by which existing conceptual models can be made operational, however. We conclude that any claim that the CVM enjoys a "strong theoretical foundation" is not based on unequivocal evidence. Empirical tests of the consistency between

⁷ See, as examples, Cummings, Brookshire and Schulze [1986], Mitchell and Carson [1989] and, more recently, Carson [1991], Carson and Mitchell [1992] and Schulze [1992].

⁸ For an example of what would appear to be an opposing view regarding priority, see Carson [1991] or Schulze [1992].

⁹ The question as to what "reasonably" might mean is taken up in Section 3, *Do CVM Values Closely Approximate Real Economic Commitments?*

individual behavior in the CVM and the assumptions of received theory are at the *very best* inconclusive. Unequivocal evidence does not exist that would support the conventional wisdom that CVM subjects do not behave strategically. Finally, any assertion that CVM values are reasonable estimates of values which people hold for natural and environmental resources is without foundation, if by "reasonable" one means that CVM values are close approximations of amounts that people will actually pay for a good. Available empirical evidence suggests that large differences may exist between amounts that people say they will pay in a CVM and amounts that they will actually pay.

Our conclusions may fail to fully satisfy readers with purely academic interests in the CVM as a method for valuing public goods, as well as readers concerned only with the bottom line concerning the substance of values estimated with the CVM.

The academician may well inquire if our intent is to suggest the lack of any basis for intellectual interest in the CVM. This is certainly not our intention. For the experimental purposes which motivate academic interest in the CVM as a possible means for valuing public goods, the CVM may remain as a topic of interest for many scholars; it does for us. For these purposes, the academician may regard as interesting the simple finding that CVM values are "correct" in terms of having theoretically predicted signs (the values are positive, not negative). If, however, one is to put CVM values to uses which presume any large degree of accuracy, such uses enjoy neither theoretical nor empirical justification. Our conclusions are intended to suggest a need to carefully re-examine our "knowledge" of the substance and structure of the CVM, to recognize that many issues that we have regarded as being resolved in fact remain unresolved, and that until they are resolved the CVM is best viewed as a method that remains at a relatively infant stage of experimental inquiry. They then may be seen as an echo of the appeal by Kopp and Smith [1989; p. 607] for intellectual introspection as to what we know and don't know regarding these issues:

"[referring to the 'new level of specificity' for CVM values required by its use in CERCLA adjudications...] we should evaluate what we know and, equally important, what we don't know about valuing natural resources as *assets* that provide diverse services supporting a wide range of utility-generating activities."

To readers with interests only in the bottom line, *do* nonuse values exist and *can* they be measured with the CVM, we can only respond in the following way. Nonuse values can be justified conceptually. In terms of their measurement with the CVM, one can obtain estimates

for them. How such estimates are to be interpreted is another issue. We know little at this point about the precise relationship between nonuse values or total values obtained with the CVM and values that reflect real economic commitments. The sparse evidence that we have in these regards suggests that this relationship will likely be very imprecise, with CVM estimates overstating real economic commitments by substantial amounts.

Our argument is structured as follows. The theoretical foundation of nonuse values is considered in Section 2. The theory of option values is discussed, and the evolution of other nonuse values is described and critically analyzed. Section 3 addresses the CVM as a means for measuring values for nonpriced goods by users and nonusers. Attention is focused on two questions: is the CVM based upon a strong theoretical foundation, and does existing empirical evidence demonstrate that people will actually pay what they say they will pay in the CVM? Conclusions are set out in Section 4.

A final observation is warranted before we move on to the arguments to be developed in our report. Our limited focus on the small set of issues that we argue to be central to assessments of nonuse values and the CVM has expository advantages and disadvantages. A major advantage is that it may serve to suggest caveats for uses of the CVM and to suggest priorities for future methods development research. A major disadvantage may be that, in limiting our discussions of colleagues' papers to aspects that relate to the issues of interest here, we fail to give full credit when it is due. A few examples may serve to make this point clear. We take sharp issue with interpretations given *specific aspects* of earlier works by such scholars as Bill Schulze, David Brookshire and Alan Randall, among others. Time and resources prohibit a broader review of all of their works, a review that would place the works that we cite in their appropriate state of the art context. Only in that context can the contributions of these scholars in providing intellectual leadership for imaginative and innovative inquiry regarding public goods valuation be fully appreciated. In terms of more recent works, we are particularly critical of positions taken *vis-a-vis* the set of issues of interest here by Robert Mitchell and Richard Carson [1989]. Their 1989 book is considered by many to be one of the "bibles" on the CVM. Positions taken by or attributed to these and other scholars that relate to what we refer to as "fundamental issues" are important for the conventional wisdoms of concern to us. We wish to make clear, however, that our critiques of aspects of work by these scholars are not meant to detract from the weight of their more general intellectual contributions to the state of the art.

Section 2

OPERATIONALLY MEANINGFUL THEOREMS FOR NONUSE VALUES

A. OVERVIEW

There is a considerable literature on the benefits associated with public goods in general, and natural resources in particular. In reading a good part of this literature one is invited to accept as a matter of course that nonuse values are well established in economic theory and that their magnitude is large *vis-a-vis* total values associated with environmental resources.

Moreover, the same applies with reference to the alleged "components" of nonuse values: option value, existence value and bequest value, to name but a few. In Table 1 we provide a small sample of citations which refer to such values. These references suggest a state of the art in which motive-related values enjoy a presumption of validity, are measurable, have been measured, and are "large" relative to any use-related value.

Our concern in this section is with this conventional wisdom concerning nonuse values. We address three interrelated sets of questions. First, to what extent are concepts of nonuse values based on operationally meaningful theorems in economics? Second, based on an assessment of the published works which are cited as providing empirical evidence of the existence of these many nonuse values, do the studies actually show what they purport to show: a derivation of nonuse values and their decomposition into various types of nonuse values? Finally, we ask: is there a well-reasoned rationale for our interest in nonuse values?

To provide the reader with an overview of the topics to be discussed in this section, we briefly outline the main line of argument.

We continually refer to the notion of *operationally meaningful theorems*, so we begin with a brief discussion of this concept (subsection B). The notion of a nonuse value, as it relates to the valuation of natural and environmental resources, has its origins in discussions related to a value associated with use: *option value* (subsection C). While, as we argue, the option value notion was lacking in terms of operational meaningfulness, it played an important role in enhancing economic analyses of decisions affecting unique and irreplaceable assets (subsection D).

Table 2-1. Selected Citations Referring to Nonuse Values

"Many of the formal inquiries using CVM...give evidence that nonuse benefits of improvements in water quality (which include option value as well as existence value) tend to be some fraction of the use value (...) Other research...shows that existence value is greater than use value, and in the (Schulze *et al.*, 1983) case, is substantially greater." Madariaga and McConnell [1987; p. 936]

"...(citing, among others, Schulze *et al.* [1983]) the magnitude of the estimated option value in relation to the estimate of the expected consumer surplus has been much larger than expected from theory." V.K. Smith [1987; p. 283]

"Ambiguities may be present in existence values as well (as option value), but such information collected from well-run studies can be useful in making choices where resources might be irreversibly destroyed (Brookshire, Eubanks and Randall, 1983)." Kaiser, Brown and Davis [1988; p. 11]

"Contingent valuation studies have also documented considerable willingness to pay for existence. For example, Schulze *et al.* (1983) found that estimates of willingness to pay to preserve visibility at the Grand Canyon were dominated by existence values. Other contingent valuation studies that found a willingness to pay for existence were reported by Brookshire, Eubanks and Randall (1983). (...) While (earlier studies) provide conclusive evidence that some members of our society value the preservation of species or areas of special significance, they offer little indication of the pervasiveness of existence value." Boyce, Brown, McClelland, Peterson and Schulze [1989; pp. 306-307]

"The most popular decomposition (of total values) is between use and existence values. This happens because existence values typically are not measured by other benefit measurement techniques, such as travel cost analysis. The exclusion of existence values creates a bias in the travel cost analysis...." Carson [1991; pp. 127-128]

"In contrast to use values, which exist because people are physically affected by an amenity, existence values, or more generally nonuse values, embody the notion that a person need not visit a physical site or use services from that site to gain utility from its maintenance or improvement. The motives for existence values usually stem from vicarious consumption or stewardship concerns." Carson and Martin [1991; p. 393]

"...total economic value is made up of five components: (1) onsite recreation use of the resource; (2) commercial use of the resource; (3) an option demand from maintaining the potential to visit the resource in the future; (4) an existence value derived from simply knowing the resource exists in a preserved state; and (5) a bequest value derived by individuals from knowing that future generations will be able to enjoy existence or use of a resource." Loomis, Hanemann and Kanninen [1991; pp. 412-413]

"In addition to economic values of onsite recreation use and commercial uses of wildlife, there are many offsite user values. These include option, existence, and bequest values, all of which can be held by the general population as well as recreationists." Cooper and Loomis [1991; p. 448]

Assume for the moment that we can estimate an individual's maximum willingness to pay (WTP), or *total value*, for such assets.¹⁰ In this case, the relevance of option or nonuse values, as components of total value, dissipates for other than pedagogic purposes. The 1964-1980 period saw many efforts to develop methods for measuring total WTP (subsection E). These efforts parallel in time the debate concerning option values, but are somewhat set apart from that debate.

From 1981 on, we begin to find option value theories merged with efforts to value public goods (subsection F). This is the period of time in which we see the ascension of nonuse values, particularly "existence" values, to an asserted position of primary importance. We examine in detail the studies which are most often cited in the literature as providing compelling evidence that nonuse values can be measured and that they constitute a large proportion of individual's total WTP for an environmental good, and briefly comment on other studies that explore means by which nonuse values might be measured. Efforts to theoretically decompose total values into use and nonuse components are reviewed in subsection G.

We conclude this section with an effort to bring all of these points together to the end of presenting our view of the importance and significance of nonuse values in terms of the state of the art for valuing natural and environmental resource values (subsection H).

B. WHAT ARE OPERATIONALLY MEANINGFUL THEOREMS?

Referring to economic theory in general, Samuelson [1947; p.4] defined an operationally meaningful theorem as:

... simply a hypothesis about empirical data which could conceivably be refuted, if only under ideal conditions. A meaningful theorem may be false. It may be valid but of trivial importance. Its validity may be indeterminate, and practically difficult or impossible to determine. Thus, with existing data, it may be impossible to check upon the hypothesis that the demand for salt is of elasticity -1.0. But it is meaningful because under ideal circumstances an experiment could be devised whereby one could hope to refute the hypothesis.

¹⁰ This assumption sets aside questions as to the substance and reliability of WTP measures for natural and environmental resources derived with the CVM or other methods. These issues are addressed in Section 3.

A theorem or hypothesis concerning values which individuals might place on nonmarket goods is operationally meaningful only if we can conceive of an experiment whereby the hypothesis might be refuted.

Our purpose in stressing the importance of distinguishing between theorems and operationally meaningful theorems is not simply pedagogical. The distinction is relevant for our critique of the literature on nonuse values in which we find a persistent failure to distinguish between *observable behavior* and the *unobservable motivations* (or tastes or preferences) of individuals.¹¹ Thus, in terms of the hypothesis that individual demand for any good is inversely related to the good's price, we can observe changes in prices and observe any changes in purchases of the good. We can readily conceive of observations that would refute the hypothesis. On the other hand, a theorem (implicit to a number of nonuse value studies reviewed below) stating that "individuals offer this value *because* they value the very existence (or any other asserted nonuse motive) of a good" is not operationally meaningful and can be given no higher status than an assertion. We cannot observe tastes or motivations. We cannot observe *why* a subject offers any particular value. One may have opinions as to motives that lead subjects to particular actions, but these are not to be confused with operational theorems.

C. IN THE BEGINNING THERE WAS OPTION VALUE

The nonuse value concept in environmental and resource economics had its origin in a scholarly debate concerning a very specific problem. The contributions of Burton Weisbrod [1964] and John Krutilla [1967] to this debate are widely viewed as seminal. In *Capitalism and Freedom*, Milton Friedman [1962; pp. 31 ff.] argued that a public facility, such as a national park, should be closed if it cannot be maintained by user fees. This view was challenged by Weisbrod, who posits that closure of the park could result in the land being put to residential or commercial uses. He further assumes that it would be prohibitively costly to revert to a park use of the land at some future date. Since the closure effectively represents

¹¹ Samuelson [1947; p.3/4] offers an observation that we will later show comes uncomfortably close to describing some of the literature on nonuse values: "...only the smallest fraction of economic writings...has been concerned with the derivation of operationally meaningful theorems...We do not have to dig deep to find examples...Take a little bit of bad psychology, add a dash of bad philosophy and ethics, and liberal quantities of bad logic, and any economist can prove that the demand curve for a commodity is negatively inclined." Two studies that explicitly raise the question of the operational meaning of distinctions between use and nonuse values are Smith, Desvousges and Freeman [1985; p. 6-7] and Freeman [1992; p. 8ff.].

an irreversible decision, we refer to the park as an irreplaceable asset.¹² Weisbrod then poses the question: how do we value such an asset?

Weisbrod's theory of option value consists of a line of deductive reasoning. There *may* be a number of individuals who, while they do not use the park or are infrequent users, would like to see the park retained and would be willing to pay some amount to see it retained. Since they do not use the park, or use it only infrequently, they do not pay significant fees in aggregate. Moreover, there exists no mechanism by which the fees which they *might* pay to keep the park open can be recognized. Weisbrod refers to the maximum amount of these fees which these nonusers would be willing to pay to keep the park open as an "option value." As the name implies, this value relates to the amount which nonusers and infrequent users would pay to retain their *option* to use the park at any future time. Note that option value as set out by Weisbrod is a *use*-related concept.

An individual's WTP for insurance, for having some asset on "stand-by," or for protecting one's options, is not limited to parks. Weisbrod notes the possible willingness of individuals who have never visited, and hope never to visit, a hospital to vote for bonds required to build or maintain a hospital.

There are two important aspects of Weisbrod's theory for present purposes. First, his premise is that individuals may be willing to pay for an asset that they do not use as a result of their preferences related to a desire to maintain their option to use it. He does not consider *other* motivations (e.g., bequest) which might lead an individual to the same behavior -- paying to maintain an asset which the individual does not use.¹³

¹² Some later writers have casually suggested that "irreplaceability" is somehow essential to the question of option demand or, more generally, nonuse values. It is useful to note that the characteristic of "irreplaceability" is just an extreme case of the situation posited by Weisbrod. He clearly envisaged less extreme situations as being relevant for option demand: "Infrequency and uncertainty of [future] purchase are not the only conditions bringing about a potential deviation of optimal private from optimal social behavior. In the present context there is another requirement: expansion or recommencement of production at the time any occasional-purchasers wish to make a purchase must be difficult (in time or resources) or impossible; this implies that storage of the commodity (service) must be expensive -- at the limit, impossible. In the case of a natural phenomenon such as Sequoia National Forest, if the trees were destroyed (allocated to alternative use), centuries would be required to restore them." (p.474).

¹³ This should not be taken as a criticism of Weisbrod's argument, so much as an implicit caveat that has been ignored by later writers.

Secondly, Weisbrod does not offer his theory as being an operationally meaningful one.¹⁴ On the contrary, he notes the absence of markets by which relevant options might be purchased. Weisbrod sees the importance of option demand arising in situations where user charges fall short of the incremental cost of providing services. In such cases, recognition of option demand may dictate the necessity of public operation of the enterprise (p. 476).

These ideas are extended by Krutilla [1967] beyond the use-related setting of Weisbrod's arguments to include nonuse related considerations. Like Weisbrod, Krutilla's concern is with the underestimate of true social values of an irreplaceable asset which would result from a sole reliance on user fees. His argument extends naturally beyond user fees to any metric which captures only directly observed values from users. Krutilla makes compelling the case that *some* individuals will hold nonuse values for *some* irreplaceable assets.

Two aspects of Krutilla's arguments concern us here: his introduction of "existence" and "bequest" motives, and the operational meaningfulness of his conclusions.

Krutilla, unlike Weisbrod, does consider tastes, preferences or motivations which might lead a nonuser to be willing to pay some amount to maintain an irreplaceable asset other than those which are related to any strict interpretation of an individual's desire to maintain his or her options for future use. He argues that an option demand may exist even among nonusers who place a value on the mere existence of such assets (p. 781), or among those with "bequest" motivations (p. 781, fn. 11). It is useful to consider carefully Krutilla's exposition of the *bequest* and *existence* motives which might give rise to an option value or, more generally, any nonuse value.¹⁵ All references by Krutilla to these motives are set out in

¹⁴ In the strict sense Weisbrod does concern himself with the operational meaningfulness of his claims as to the existence of option value. He argues clearly that: "This 'option value' should influence the decision of whether or not to close the park and turn it to an alternative use. But it probably will not exert any influence if the private market is allocating resources, because there may be *no practical mechanism* by which the entrepreneur can charge nonusers for this option. Schemes to charge them *can be imagined*, but non-coercive devices may be *extremely difficult to implement*." [1964; p.472, emphasis added]. He sets out an explicit procedure (p.472, fn.3) to elicit values from agents that do not use the park in a given year, noting clearly how difficult it would be to practically implement. He also explicitly recognizes the problem of free-riding responses to his procedure, but subsequent literature on demand-revelation suggests procedures that can address this problem (e.g., the Groves-Clarke Pivot Mechanism).

¹⁵ We note that in some parts of his arguments Krutilla does not distinguish between values reflecting motives related to the preservation of options and nonuse motives. For example, "An option
(continued...)"

Table 2. We see in these statements no more than arguments as to *possible motives* which might lead a nonuser to value an irreplaceable asset.¹⁶ An individual's value for the asset may be motivated by preferences related to preserving an option for use, an option for use by future generations, or the mere existence of the asset. We find nothing in these arguments that would suggest Krutilla's intention to argue that these motivations are in some sense distinct and separable, and that one therefore looks to separate and additive values associated with the individuals preferences related to option, bequest and existence motives.

Krutilla made no claims for the operational significance of his expanded view of nonuse value.¹⁷ There is no suggestion in his work that one might observe monetary values derived from option, bequest or existence motives, other than in extremely imperfect ways.¹⁸ Krutilla looks to what he views as the compelling *a priori* case that *some* individuals hold such values as making a *prima facie* case for the conservation of unique environmental assets.

There is a subsequent literature which attempts to formalize the option value concept and to probe its relationship to total values which individuals might place on the loss of an asset. The following relationship evolved slowly: a total value, called Option Price (denoted OP) is the sum of Option Value (OV) and Expected Consumer Surplus from anticipated future use of the asset (ECS). Thus we have $OP \equiv OV + ECS$. Option value was viewed as motivated by

¹⁵(...continued)

demand may exist...among others who place a value on the mere existence...." (p. 781) Contemporary conventions make such a distinction. Option value is use-related, and existence value, bequest value, etc. are related to nonuse motives.

¹⁶ Or, by logical extension, motives which might lead a user to value the resource at levels that exceed any reasonable use-related level.

¹⁷ Krutilla [1967; p.785] explicitly concludes that we "have virtually no knowledge about the possible magnitude of the option demand. (...) Obviously, a great deal of research in these areas is necessary before we can hope to apply formal decision criteria comparable to current benefit-cost criteria. Fully useful results may be very long in coming; what then is a sensible way to proceed in the interim?" The interim solution proposed is to use a pessimistic min-max decision rule (to determine the "*minimum* reserve to avoid potentially *grossly adverse* consequences for human welfare") quantified with "educated guesses."

¹⁸ He argues (p.781) as follows: "If a genuine value for retaining an option in these respects exists, why has not a market developed? To some extent, and for certain purposes, it has. Where a small natural area in some locality in the United States is threatened, the proposal is often purchased by the Nature Conservancy [...], a private organization which raises funds through voluntary subscription [...]. But this market is grossly imperfect."

Table 2-2. Krutilla on Existence and Bequest Motives

REFERENCES TO "EXISTENCE"

"...[referring to natural environments that have no close substitutes] it is not clear even on theoretic grounds that a comparison of the total area under the demand curve on the one hand and market receipts on the other will yield an unambiguous answer to the allocative question. When the existence of a grand scenic wonder or a unique and fragile ecosystem is involved, its preservation and continued availability are a significant part of the real income of many individuals [footnote 7]." p. 779.

[footnote 7: "These would be the spiritual descendants of John Muir, the present members of the Sierra Club, National Wildlife Federation, Audubon Society and others to whom the loss of a species or the disfigurement of a scenic area causes acute distress and a sense of genuine relative impoverishment."]

"There are many persons who obtain satisfaction from mere knowledge that part of wilderness North America remain even though they would be appalled by the prospect of being exposed to it.... An option demand may exist therefore not only among persons currently and prospectively active in the market for the object of the demand, but among others who place a value on the mere existence of biological and/or geomorphological variety and its widespread distribution [footnote 11]." p. 781.

[footnote 11: The phenomena discussed may have an exclusive sentimental basis, but if we consider the "bequest motivation" in economic behavior, discussed below, it may be explained by an interest in preserving an option for one's heirs to view or use the object in question."]

"If a genuine value for retaining an option in these respects exists, why has not a market developed?... perhaps of greatest significance is that the preservation of the grand scenic wonders, threatened species, and the like involves comparatively large land tracts which are not of merely local interest. Thus, all of the problems of organizing a market for public goods arise. Potential purchasers of options may be expected to bide time in the expectation that others will meet the necessary cost, thus eliminating cost to themselves. Since the mere existence or preservation of the natural environment in question satisfies the demand, those who do not subscribe cannot be excluded except by the failure to enroll sufficient subscribers for its preservation." pp. 781/2

REFERENCES TO "BEQUEST"

"... [within the context of technological progress, while other goods may realize continuous expansion] by reason of scientific discovery and mastery of technique, the supply of natural phenomena is virtually inelastic. That is, we may preserve the natural environment which remains to provide amenities of this sort for the future, but there are significant limitations on reproducing it in the future should we fail to preserve it." p.783

"We are coming to realize that consumption-saving behavior is motivated by the desire to leave one's heirs an estate... A bequest of maximum value would require an appropriate mix of public and private assets, and, equally, the appropriate mix of opportunities to enjoy amenities experienced directly from association with the natural environment along with readily producible goods. But the option to enjoy the grand scenic wonders for the bulk of the population depends upon their provision as public goods." "... some portion of the estate would need to be in assets which yield collective consumption goods of appreciating future value." p.784

"Given the irreversibility of converted natural environments, however, it will not be possible to achieve a level of well-being in the future that would have been possible had the conversion of natural environments been retarded. That this should be of concern to members of the present generation may be attributable to the bequest motivation in private economic behavior as much as to a sense of public responsibility." p.785

a desire for insurance¹⁹, and led to extensive theoretical studies into the effects of risk-spreading on the structure of an option value.²⁰ Potential impacts on the size of OV from asymmetric technologies were explored.²¹ The debate expanded to questions concerning whether or not OV might double-count consumer surplus²² and the conditions under which it might be negative in sign.²³ The importance of income and substitution effects on an OV was stressed. The role of uncertainty, both as to future demands and future conditions of supply, was explored at some length.²⁴

Detailed examination of the twists and turns in the option value literature during the 1970s is irrelevant for our primary interests. All of these studies share one thing in common with Weisbrod [1964] and Krutilla [1967]: none argues for the operational meaningfulness of the option value concept. While one does not find in this literature arguments that option value might in fact be measured in some separable sense, arguments concerning the operational meaningfulness of theorems and hypotheses related to other values do arise. Specifically, the issue of whether or not one might be able to measure the ECS component of an OP is addressed by Cicchetti and Freeman [1971] and Krutilla, Cicchetti, Freeman and Russell [1972], amongst others.

Beginning with the posited relationship between OP, OV and ECS noted above (viz., $OP \equiv OV + ECS$), and acknowledging our inability to observe OP and OV, these studies inquire as to

¹⁹ The notion of a *quasi-option value* is introduced by Arrow and Fisher [1974]. A quasi-option value is said to arise in instances where today's decision is not in the nature of a "once-and-forever preserve or don't preserve" choice concerning the asset, but one where we decide whether or not to postpone the "preserve or don't preserve the asset" decision until some future time at which more information is available. Quasi-option value is essentially a value for information (see Conrad [1980], Fisher and Hanemann [1987] and Freeman [1984a]).

²⁰ See, e.g., Schmalensee [1972], Cook and Graham [1977], and Zeckhauser [1969].

²¹ The notion here is that activities (e.g., hydroelectric power) which might replace an environmental asset (e.g., the Grand Canyon) may be affected by technological advance which lowers the price of their output, while such advances will not affect the environmental asset. On the contrary, with rising incomes over time, the demand (and therefore the price or value) of the environmental asset should rise. Moreover, the rent of some asset is directly influenced by the value of the next foregone alternative, so anything that changes the value of such alternatives will change the rent that must be imputed to an asset. See Krutilla, Cicchetti, Freeman and Russell [1972] for further discussion.

²² See Byerlee [1971].

²³ See Schmalensee [1972], Freeman [1984] and V.K. Smith [1984].

²⁴ See Graham [1981] and V.K. Smith [1979] [1987].

how large OV would have to be to substantively affect decisions concerning the preservation of an environmental asset. For the social benefits from preserving the asset to be greater or equal to the cost of preserving the asset (denoted COST) we must have $\text{COST} < \theta + \text{ECS}$, where θ denotes the unknown OV. At issue here is how large θ needs to be so as to bring about this condition. These studies proceed to estimate ECS for the purpose of comparing it with an estimate of COST and then deriving the "necessary" magnitude of θ if the asset is to be preserved. There is no claim that option value is being estimated directly or indirectly.

Along similar lines Schmalensee [1972] argues that the valuation of environmental assets using only measures of ECS might be accepted as a "best available technology" given that OV cannot be observed.²⁵ He arrives at this conclusion by showing theoretically that OV for an individual could well be positive or negative, depending on a myriad of unobservable characteristics of preferences of the individual. Arguing implicitly from the perspective of "the principle of insufficient reason" that there is no *a priori* reason for OV to necessarily take on positive or negative values, he suggests that the best guess at the likely value is zero. Tenuous as this argument is, it demonstrates well the perception of the literature at the time that one could not hope to ever operationalize the estimation of option value.

D. OPTION VALUE, PERSPECTIVE AND THE PRE-1980 STATE OF THE ART

It is important to place the literature concerning option value in its proper perspective in terms of the time at which the research was undertaken. The question to be addressed here is why the notion of option value was considered an important one at the time.

Until the early 1980s, the view held by *most* economists was that one could not hope to measure total values for public or nonmarket goods. This is *not* to say that *all* economists

²⁵ A brief comment is in order as to the operational meaningfulness of any theorems underlying efforts to measure ECS. Standard assumptions about individual behavior allow one to derive a theorem which essentially states that an individual's valuation for some future use is the present value of the satisfaction or utility which he expects to derive from that use. This specific value cannot be directly observed, however. As noted by Bohm [1975], conceptually ECS must consist of: the individual's perceptions of all likely future uses of the asset, the individual's valuation of each use, and the individual's subjective probability that the use will take place. Since these contingent perceptions and valuations cannot be observed either, efforts by Krutilla, Cicchetti, Fisher and Russell [1972] to measure ECS were based upon extrapolations of aggregate data. Aggregate visitation at parks is derived from projections of future populations and projected characteristics (income) of the future populations, which are then used to estimate future visitation. Values are derived from projected user fees (and considerations of travel costs). Aggregate probabilities of use are based upon past and projected participation rates of the population.

held this view. Paralleling (in time) the option value debate were attempts to develop methods for obtaining total values for public goods.²⁶ It was generally the case that economists had accepted the proposition set out by Samuelson [1954] that efforts to derive such values by any means involving an individual being asked to reveal his true maximum WTP for a public good would be doomed by the incentives for individuals to behave strategically and free-ride. If the individual felt that his actual tax or payment would be linked to his expressed WTP, but that the public good's provision level did not depend on his expressed WTP, then the individual would understate the true WTP and thereby free-ride on the expected contributions of others. If such a link was not present, an individual interested in having the public good provided would be motivated to overstate a true value in hopes of affecting the decision concerning the provision of the good.

In an intellectual milieu where many believed that we could not observe the total value which individuals place on environmental assets, the importance of the option value concept was immediate. It established the principle that use-related values such as entrance fees *could understate* any measure of social benefits attributable to the asset.²⁷ Social decisions based on comparisons of costs with benefits so understated could then result in a misallocation of resources. In this context, the option value concept was surely important, notwithstanding its lack of operational meaningfulness. Even if it could not be observed and therefore measured, it served as a reminder to policy makers that decisions which are irreversible in nature should not be based on *strict* adherence to a benefit-cost test based solely on measurable benefits. The benefit side of the equation was claimed to be flawed, and perhaps substantially so.

Is the concept of an option or nonuse value of any importance in other contexts, particularly those in which we believe that we *can* measure an individual's *total* value for an environmental asset? Given the problem ("we can't measure total value") which motivated interest in the option value argument, one can only speculate as to whether Weisbrod [1964] or Krutilla [1967] would have thought about nonuse value at all if they had thought that an individual's maximum WTP for public goods was observable.

Whatever the answer to this question, however, it is difficult to imagine a motivation for one's

²⁶ See Freeman [1979] for a thoughtful overview of the state of the art for public goods valuation at the close the 1970s.

²⁷ To the extent that OV can theoretically be negative, however, a presumption that ECS is positive does not ensure that OP ($\equiv$ OV + ECS) is always going to be positive.

interest in *disaggregating* a measure for maximum WTP into motive-related components (even if one could do so, which we will argue that you cannot). Accepting for the moment the relationship $OP \equiv OV + ECS$, if we know OP then what could possibly motivate our interest in knowing OV or ECS ? We can think of no application of benefit-cost analysis or damage assessment for which we might wish to pick out OV or ECS and compare it with some component of cost.²⁸

One possible argument for wanting to disaggregate use and nonuse values, as we see it, is to apportion financing charges proportionately for some public good. The argument would run along the same lines introduced by Weisbrod [1964]. If we can readily identify the users of some resource or commodity, then there is relatively little conceptual or practical problem in getting them to pay for the commodity, providing it is a private good or has significant private good aspects (e.g., a subway system). The nonusers, however, cannot by construction be excluded from consumption if they do not reveal themselves by the act of consumption. If we could estimate the importance of nonuse value in relation to use value, however, we could determine the extent of a subsidy to come from nonusers *via* general taxation (and a rebate given users due to their being charged twice *via* taxes and tickets).²⁹

We do acknowledge one further reason for having to identify the use-value component of total value: uncertainty over the legal status of total values that include nonuse values, or that make no effort to factor them out. Prior to the ruling in *State of Ohio v. U.S. Dept. of the Interior* (880 F.2d 432, D.C. Cir. 1989) on July 14, 1989, the Department of the Interior had promulgated regulations in August 1986 for damage assessment in certain cases that limited damages to the lesser of restoration cost or lost use value. The Court struck down "the lesser

²⁸ Carson [1991; p.128, fn.6] makes this point very clearly. It is also apparent when one confronts the type of policy problems for which CVM is being used. Good examples include the World Bank's efforts to value alternative water supply scenarios in developing countries (see Briscoe *et al.* [1990]) or the Australian Government's efforts to decide whether or not to mine near the Kakadu National Park (see Imber, Stevenson and Wilks [1991]). Issues of nonuse values are mentioned in these studies, but there is no interest in attempting to measure them since the CVM provides estimates of total value which is all that is needed for the policy exercise. How reliable those estimates are is a matter for discussion in Section 3.

²⁹ Such a scheme is not so straightforward in practical terms, however. We must distinguish between values of *nonusers* and values of *users* which may include nonuse motives. An ethical question arises. If nonusers are to be taxed their value, what of the nonuse component of user's values (setting aside, for the moment, problems with measuring such a component)? The confounding implications of nonuse values *of users* for any practical considerations of an equitable rebate designed to offset double charges are immediately obvious.

of" rule, and allowed lost nonuse values to be claimed as well as lost use values. Given the uncertainty over the legal status of nonuse value during this period, it is natural for litigants to want to have damage assessments prepared with and without nonuse values. Hence a derived demand for studies attempting to identify and measure nonuse values as a component of total values.

E. SEPARATE BUT PARALLEL ADVANCES IN METHODS FOR VALUING PUBLIC GOODS

During the period extending from the early 1960s through about 1980, a relatively small group of scholars was involved in efforts to develop methods by which one might obtain an individual's maximum WTP for a particular environmental asset. Two aspects of this research are important for the present line of argument. First, the public goods of interest for these researchers were not limited to those of the "irreplaceable" genre. Secondly, the research was concerned solely with obtaining a *total* value for the good under study. In initial empirical studies of environmental values, option or nonuse values are not at issue.³⁰

While we see in this period the early stages of efforts to develop a number of methods which might be used to value nonmarket goods, we limit our focus to the Contingent Valuation Method (CVM).³¹ Given the influence of Samuelson's [1954] earlier-mentioned "strategic bias" proposition on the economic profession's view of the public goods valuation issue, we should note that by the late-1970s the strength of that proposition was viewed by many as having been weakened by results from empirical tests of the strategic bias hypothesis presented by Vernon Smith [1977] [1979a] [1979b] and Bohm [1972] [1979].³² This view is assessed in some detail below in Section 3, *CVM Valuation Behavior and the Incentives Assumption*.

³⁰ The potential relationship between total values for environmental improvements and nonuse values is noted in other works, however. See, for example, Freeman [1979; p. 249].

³¹ The CVM was also known initially as the "bidding" or "asking" game. Experiments with two other methods, and their variants, were also taking place during this period: the Hedonic Price Method and the Travel Cost Method. For an overview of these methods, see, as examples, Freeman [1979], Cummings, Brookshire and Schulze [1986], Mitchell and Carson [1989], and Braden and Kolstad [1991].

³² For a contrary view, see Freeman [1979; Chapters 5, 10].

Throughout this period, the CVM was used to value a number of diverse natural resource and environmental goods. A nonexhaustive list of examples includes aesthetic visibility, recreation facilities, elk hunting, noise pollution, and the maintenance of instream flows.³³ Ignoring for the moment questions concerning the accuracy of measures derived with the CVM, our present concern is with one aspect of these studies: are the methods used to obtain estimates for values based on operationally meaningful theorems?

As a conceptual basis for their valuation methods, which involved simply asking people their maximum WTP for a posited environmental change, these studies appeal to the "bid curve" developed by Bradford [1970] and based on arguments introduced by Samuelson [1954]. For market goods one can logically derive from the premises of value theory testable hypotheses concerning behavioral responses (choices of quantities) to changes in prices. Such hypotheses are operationally meaningful inasmuch as we can conceive of experiments whereby individual responses to changes in prices can be observed. Similarly, one can conceive of experiments that change the quantity available and elicit the new demand price (or WTP) at the new quantity.³⁴

In the case of public goods, "quantity" changes may in fact involve changes in quality. This will be particularly common for environmental goods. Appeal can be made to received value theory to derive hypotheses concerning behavioral responses (changes in prices or values) to changes in quantity or quality. Such hypotheses are operationally meaningful inasmuch as we can conceive of experiments whereby the quantity or quality of a public good is changed, and then observe behavioral responses (a reported WTP). Samuelson [1954] and Bradford [1970] demonstrate that the appropriate measure of social benefits implied by this approach is the vertical summation of individuals' observed maximum WTP at each given quantity.

This discussion anticipates the problems with the CVM to be taken up in Section 3: how is the quantity or quality of the environmental good being changed communicated to the subject, and how are we to interpret the value which is "observed?"

³³ See Randall, Ives and Eastman [1974], Rowe, d'Arge and Brookshire [1980], Brookshire, Ives and Schulze [1976], Loomis [1986] [1987], Brookshire, Eubanks and Randall [1983], Thayer [1981], Greenley, Walsh and Young [1981] and Daubert and Young [1981].

³⁴ As we discuss below in Section 3, when the change in quantity and WTP are *hypothetical*, a critical assumption must be accepted: that the "observed" WTP is an amount that individuals will actually pay.

F. MEASURING DISTINCT NONUSE VALUES WITH THE CVM

We return now to the topic of primary importance in this section: nonuse values. Beginning in the early 1980s, the focus of many empirical studies with the CVM turns to the *components* of total value estimates and to attempts to measure these components separately. We find this shift in emphasis in CVM research to be curious. All else equal, CVM researchers might have found the option value literature to be of little interest for them. Lacking a means for directly estimating total values associated with nonpriced goods, contributors to this literature viewed option value as a vehicle for arguing that available value measures based solely upon use might be expected to underestimate total values for nonpriced goods, particularly those of the irreplaceable genre. However, CVM researchers had the means for estimating total values. The rationale for concern with option values, or any other motive-related value, was then moot.

In any case, this focus quickly led to a proliferation of assertions concerning many nonuse values. Seemingly, to some, each of the *motives* suggested by Krutilla [1967] as potentially resulting in an individual's WTP to preserve environments would give rise to a *separable value*. Examples of the "values" which preoccupied many researchers from 1981 to the present day include: existence, bequest and option.

In early studies which attempt to measure such things as option, existence and bequest values, the conceptual basis from which testable hypotheses are to be drawn is incomplete or nonexistent. For option values, typically references to the theoretical arguments found in the option value literature are given as representing the theoretical foundation for the values to be estimated in the study. The operational meaningfulness of option value models aside, these references would be relevant only for estimates of *option* values. In terms of the conceptual foundation for *other* nonuse values to be estimated, the studies either ignore this issue (e.g., Sutherland and Walsh [1985] and Daubert and Young [1981]) or they simply refer to these values as those "outlined or proposed by Krutilla" (e.g., Walsh, Loomis and Gillman [1984; p. 15] and Greenley, Walsh and Young [1981; p. 657]).

In the balance of this section, we develop two arguments. First, we find in the literature pervasive references to studies that are said to have *demonstrated* that existence values can be measured, and that they are "large" relative to total values that individuals may hold for environmental goods. Most prominent among these, in terms of the frequency of citations, are the studies by Brookshire, Eubanks and Randall [1981], Schulze, Brookshire, Walther,

MacFarland, Thayer, Whitworth, Ben-David, Malm and Molenar [1983], and Greenley, Walsh and Young [1981]. We examine these studies to the end of assessing the extent to which they in fact provide such demonstrable evidence of measured existence values and their relative magnitude.

Secondly, we briefly comment on several other prominent studies that attempt to measure nonuse values.³⁵ Our comments are primarily focused on an assumption that is seen to underlying all of these studies: use-related questions elicit *only* use-related values, and nonuse related questions will elicit *only* nonuse related values. Moreover, in some of these studies (those which elicit post-bid allocations of value across motives) one finds the presumption that the researcher can *a priori* define *all* motives that an individual might have for valuing an environmental good and that the questionnaire design can elicit values for any one of the motives of interest.

F.1 Three Early "Existence Value" Studies

We find in the literature what we regard as a conventional wisdom concerning existence values: they exist *apart from values associated with any other value-related motive*, they are measurable and have been measured, and they are "large" relative to total values for an environmental resource. The studies most often cited as providing the evidentiary basis for this wisdom are those by Schulze, Brookshire, Walther, MacFarland, Thayer, Whitworth, Ben-David, Malm and Molenar [1983], and Greenley, Walsh and Young [1981], and Brookshire, Eubanks and Randall [1983]. The first point we wish to make relates to the question of attribution: do these studies actually claim to have provided monolithic evidence for having measured existence values? To some extent, the answer to this question is "no." Some of these authors make clear the experimental, exploratory nature of their study and caveats relevant for their results. Thus, Brookshire, Eubanks and Randall [1983; p. 14] make clear that:

"There is some, *but nevertheless incomplete*, evidence that these contingent markets performed reliably...(however) some unexpected results were

³⁵ Most works conducted over the last five years or so focus simply on use value and "existence" or "intrinsic" value. In some cases "existence" or "intrinsic" would appear to be used simply as a synonym for "nonuse," without meaning to imply an argument that values associated with a specific motive are being measured (for example, see Smith, Desvousges and Freeman [1985]). Others, however, find compelling their description of values measured as those being associated with specific motives (see, e.g., Walsh, Aiken, Bjornback and Rosenthal [1987]).

obtained...we feel a *guarded optimism* about the use of contingent markets to estimate option prices. If we were to concede that the estimates generated in such markets are necessarily *indicative rather than reasonably precise* (and the empirical evidence on this point is still sketchy), we would argue (that indicative evidence is useful information)." (*emphasis added*)

Schulze, *et al.* [1983; p. 173] concede that their method, like other indirect estimation methods, are subject to errors.

The second point that we wish to make is directed to those who cite these works as having established the measurability and magnitude of existence values. We briefly examine these three studies to the end of assessing the extent to which they do indeed provide the compelling evidence implied by cited references to them.

The Schulze *et al.* [1983] study explores values for improved visibility in a group of national parks, including the Grand Canyon National Park. Two groups of subjects are interviewed in two different locations. The first location is a park site (the Grand Canyon National Park, or one of four other regional parks) and the second location is the subject's home (located in Denver, Los Angeles or Chicago). Those subjects interviewed at a park site are asked their WTP for a change in visibility, using as a payment vehicle a *daily entrance fee*. Those subjects interviewed in their homes (offsite) are asked their total WTP for the same changes in visibility at the parks, using as a payment vehicle the subjects' *monthly electricity bill*.

Implicitly, Schulze *et al.* [1983] assume the following. First, there are two, and *only two*, motives for valuing visibility changes: recreational use and "existence." Secondly, if a subject is interviewed at the park site and an entrance fee is the payment vehicle, *only use related motives* will be elicited by the WTP question. In other words, if the subject is onsite any response to a WTP question will be one for which any motives other than use will be repressed or forgotten. The resulting value is then interpreted as a pure use value. If subjects are interviewed offsite and the payment vehicle is the monthly electric utility bill, however, the *same* WTP question for a visibility change will now result in a value which reflect *all* valuation motives (limited, by assumption, to use and existence). Onsite, the subject forgets nonuse motives; offsite, they are remembered.

This is the basis for Schulze *et al.*'s [1983] measurement of existence value. They have total values from offsite subjects. They have a total value from onsite subjects, but total values from onsite subjects are *assumed* to reflect only use motives and are then taken to be use values. Since subjects can have only two motives for valuing improved visibility, use and existence which then sum to a total value, the difference between their total values and use values is by definition an existence value.

We acknowledge the possible intuitive appeal of the following argument: if you ask a subject that is visiting a park how much more he'd pay to get in the park, he's thinking about getting in the park to use it. We find equally appealing, however, the possibility that subjects may be emotionally moved by the beauty of a natural environment, and in responding to a WTP question may reflect on any number of motives: existence, bequest, national pride, or even self-esteem. In our view, all that one can claim from this procedure is that it measured two sets of total values. We find no compelling basis for claims that onsite subjects offered pure use values.

A remaining question concerns the source for the oft-cited "large" existence values, relative to total values, which are claimed to have been identified in this study. As noted above, Schulze *et al.* [1983] define existence value as the difference between values obtained from offsite subjects who report a WTP as an addition to their *monthly* utility bill and values obtained from onsite subjects who report a WTP as an addition to a *daily* entrance fee.³⁶ These values do not differ to any great extent. Both values, the total value and the "use" value, are in the \$3.00-\$5.00 range. What then is the source for "large" existence values, which are the differences between these similar values? Schulze *et al.* [1983], *not the subjects*, convert these values to an *annual* value. Offsite values, in the \$3.00-\$5.00 range, are then multiplied by the frequency of utility bills: twelve. Onsite values, also in the \$3.00-\$5.00 range, are multiplied by the frequency of annual visitor days to the park, on average around two days per year. Using the lower bound of \$3.00 for illustrative purposes, total value is then \$3.00 times 12, and use value is \$3.00 times 2. Existence value is the difference between the two. The relatively "large" existence value (\$36 - \$6, or \$30) then reflects no more than the fact that 12 is larger than 2.³⁷

³⁶ We are aware of no argument that would suggest that specific payment vehicles elicit specific motives of an individual. We are aware that bids may be affected by the payment vehicle used (vehicle *bias*) but this is surely something different than what these researchers have in mind. Their vehicles, and sites, result in assumedly *unbiased* bids which reflect *different motives*.

³⁷ The obvious question here is: if asked for an *annual* WTP would off-site subjects have reported a number
(continued...)

Brookshire, Eubanks and Randall [1983] were concerned with values associated with the preservation of herds of elk and long-horned sheep. They assume that their subjects have only three possible motives for valuing herds of elk herds or long-horned sheep. Specifically, the motives are "hunting use," "observation-use" and existence. In the simplest terms, subjects are asked if they hunt or observe the herd, and are asked a WTP question related to the preservation and enhancement of the herds. If they hunt, their value is interpreted as a use value. If they see the herd but do not hunt, their value is interpreted as an observation-use value. If they neither hunt nor see the herd, their value is interpreted as an existence value.

Setting aside the imposed limitation on nonuse motives, the method used by Brookshire Eubanks and Randall [1983] was clearly an imaginative effort to explore nonuse values, and demonstrates one way to measure them. If we obtain a value from a self-reported nonuser and we can believe this reported status, then the value elicited can be defined as a nonuse value. However, a problem arises with their use values, and therefore any comparison across values. Their "use" value is a pure use value *only* if one assumes that hunter-subjects did not have or "forgot" any observer-use or nonuse motives in the formulation of their reported values. Similarly, observer-use values are pure use values only if subjects did not have or "forgot" any other nonuse motives.

Greenley, Walsh and Young [1981] set out to measure values associated with maintaining water quality in a river used for recreation purposes. Water quality in the river is threatened by a proposed plant whose waste discharges to the river would have irreversible quality effects. Subjects are asked their WTP for water quality improvements to "enhance recreational enjoyment." (p. 664). They are then asked to state other values: a value for postponing the development decision that would have the effect of polluting a river, an existence value, and a bequest value. The value of "enhancing recreational enjoyment," interpreted as a use value, and the value of postponing the development decision, interpreted as a quasi-option value, are seemingly added (p. 667). Curiously, while Greenley, Walsh and

³⁷(...continued)

\$3.00 times 12, and would on-site subjects have reported a number \$3.00 times 2? This issue relates to a fundamental problem which is explored in some depth below in section III.C: do CVM values reflect a *real economic commitment* on the part of subjects? While there exists a limited amount of empirical evidence relevant for this question as it applies to a *one-shot* commitment for a payment, there exists *no* evidence relevant for assessments of CVM responses involving a series of payments. Even if one assumes that CVM subjects will *actually* pay a reported amount one time, an assumption that enjoys less than overwhelming empirical support, there exists no basis for assuming that he or she will continue such payments. Thus, if annual values are to be used for analyses then subjects should be asked for an annual value.

Young [1981] describe their bequest and existence values as "...the values that would remain in the absence of recreation use" (p. 669), they are not added to use and option value "...because of the high probability of upward bias." (p. 669).

Greenley, Walsh and Young's [1981] subjects are implicitly of the "forgetful" genre. When asked for their WTP for a specific motive, in formulating a WTP response the subject is presumed to repress all motives other than the one stated by the interviewer. We know of no basis in economics which would support the notion that one can change the quantity of a good, ask the subject for only a specific set of motives related to this change in the quantity of the good, and then observe the change in price attributable *only* to the asked-for motives.³⁸ We then find no reasonable basis for giving motive-related meaning to the individual nonuse values set out in the study, or for meaningful comparisons between use and nonuse values.

At the time that these three studies were conducted, they were innovative efforts to explore new ground in the area of valuing nonmarket goods. Brookshire, Eubanks and Randall's [1983] study provided early evidence of values for environmental goods on the part of nonusers; note that this value is a *total* value (albeit one that Brookshire, Eubanks and Randall [1983] attribute to an existence motive). We conclude, however, that these studies do *not* provide compelling evidence that separable motive-related values can be measured or that existence values are in any sense "large" relative to total values.

F.2 Examples of Other "Nonuse Value" Studies

A number of other studies have been conducted over the last decade which empirically explore different approaches to the measurement of nonuse values. Many provide some degree of positive evidence that individuals may hold values for an environmental asset that is independent of any notion of use.³⁹ Evidence as to our ability to quantify these values is much weaker, however, other than in the case of values obtained from self-identified nonusers. This is to say that evidence for our ability to obtain values of nonusers of environmental goods must be viewed as compelling, setting aside all considerations of what

³⁸ In these regards, we may agree in principle with the argument of Madariaga and McConnell [1987] that "motives matter" (pp. 938-940) in discussions of why individual's might hold values for a resource that are not use related. Bishop and Welsh [1992; p. 12] seem to suggest that an understanding of motives might be important for distinguishing between unique and non-unique environments, or (p. 20) for assessing the validity of the CVM. Precisely how motives are to be identified and measured, or how they are to be put to these uses is unclear, however.

³⁹ See Freeman's [1992] discussion, however, of the relevance for such studies of how "use" is defined.

these values might mean *vis-a-vis* real economic commitments (a topic explored in Section 3). One must be much less sanguine as to our ability to differentiate between use and nonuse values of a user. Still weaker is evidence from empirical studies that attempt to measure components of nonuse values. Several examples drawn from better-known studies may serve to make these points.⁴⁰

We wish to differentiate between nonuse values that refer to values of a nonuser and nonuse values of a user. To this end, we refer to nonuser and nonuse values, respectively. As noted above, on conceptual grounds we see no problems with nonuser values. Such values have been identified by Brookshire, Eubanks and Randall [1983], Samples, Dixon and Gowen [1986], Boyle and Bishop [1987] and Desvousges, Smith and McGivney [1983], amongst others.

Our concern is with nonuse values as defined above. We have no quarrel with the notion that users may have such values. Our quarrel is with the extent to which these values have been measured in empirical studies conducted to date.⁴¹ One approach that has been used in efforts to measure nonuse values, as well as components of nonuse values, involves asking subjects for their total value for an environmental good, after which they are asked to allocate this total value among various nonuse categories. One sees this approach in the studies by Sutherland and Walsh [1985], Walsh, Loomis and Gillman [1984], Walsh, Sanders and Loomis [1985] and Walsh, Aiken, Bjornback and Rosenthal [1987]. As an example of this approach, Sutherland and Walsh [1985] ask subjects their maximum WTP to protect water quality at a given site. Subjects are then asked to report the percentage of this total value attributable to the following:

- (i) Payment to visit Flathead Lake or River this year, in addition to travelling or lodging expenses.
- (ii) Payment for the opportunity to visit the Lake or River in the future at the same level of water quality and fishing conditions.
- (iii) Payment to preserve water quality in Flathead River and Lake. The value to the subject from knowing that good water quality exists there.
- (iv) Payment to preserve water quality in Flathead River and Lake. The value to the subject from knowing that future generations will have good water quality.

⁴⁰ See Freeman [1992] for a similar assessment.

⁴¹ Advances in the development of conceptual models that effectively separate use and nonuse values are described below in subsection G. As noted in these discussions, however, there have been no successful efforts to implement these conceptual models.

Applying percentages reported for items (i) through (iv) to the total bid of each subject, Sutherland and Walsh [1985] interpret the value associated with (i) as a use value, and that with (ii), (iii) and (iv) as option, existence and bequest values, respectively.

The following assumptions are implied by this approach. First, since subjects are instructed that the percentages i-iv should total 100% (p. 284), subjects can have *only* value-motives related to use, option, existence and bequest, as these motives are perceived *by the investigators*. Second, subjects know values associated exclusively with each of these motives. One can only speculate as to what subjects might have had in mind in making allocations of this type. Just how subjects might differentiate between values described in questions (ii)-(iv) is surely questionable. There is an obvious potential for subjects to view as "cues" terms such as "knowing that future generations will have a good water quality." As pointed out by Freeman [1992; pp. 45-46], these kinds of allocation approaches are without theoretical justification. We find no substantive basis for the attribution of values derived in this class of studies to specific nonuse motives.

Many other studies of nonuse values were being conducted during this period, some of which were remarkable for their efforts in using techniques for design that were state of the art at that time, and for the attention given to theoretical underpinnings for their valuation process. Two examples of studies in this class, which involve subjects being directly asked for use and nonuse values, are Desvousges, Smith and McGivney [1983] and Desvousges, Smith and Freeman [1985].

Desvousges, Smith and McGivney [1983] obtain values for a number of different water quality levels in the Monongahela River. Essentially, they ask subjects for two specific values. The first value related to possible use of the river, defined by the investigators as an option price. The second value was obtained where subjects were instructed to think only in terms of satisfaction that they would obtain from changes in water quality that excludes any use of the river on their part. This latter value was interpreted as a preservation or existence value.⁴² The extent to which an existence or nonuse value was, in fact, measured by this latter question, depends on a number of considerations. In responding to the option value question,

⁴² Notwithstanding the elicitation of this value, it is not used in their analyses of values. This seemingly reflected their concerns for issues similar to those discussed below.

did subjects in fact focus only on use-related motives and "repress" any nonuse motives? Moreover, subjects had nothing in the way of motivation as to why they should imagine a set of circumstances in which they would not have access to the river.⁴³

Desvousges, Smith and Freeman [1985] value changes in risk association with policies concerning the disposal of hazardous materials. Subjects are asked to value reduction in risks *to the household* associated with a change in policies concerning the disposition of hazardous materials. They are then asked to value an *additional* regulation that would reduce ecological risks, but would not further reduce household risks. The latter value is referred to as an "existence" value. Desvousges, Smith and Freeman [1985; ch. 6] acknowledge problems associated with labeling values for the potential motives which might give rise to the value, and suggest a more general label, "intrinsic" value. Indeed, this study contains an extraordinarily thoughtful and comprehensive review of theoretical aspects relevant for nonuse values. Once again, however, their success in obtaining separable use and nonuse values with their empirical survey procedures turns on the extent to which subjects, in their introspective formulation of values associated with questions concerning household risks, in fact repressed any nonuse motives that they might have associated with the posited policy for hazardous waste disposal.⁴⁴ As in the case of Desvousges, Smith and McGivney [1983], the relevance of this issue is immediately apparent: the potential for double-counting.

Results from these studies demonstrate that nonusers may hold values for environmental goods. The *magnitude* of nonuse values is questionable, however.

Another example of efforts to measure nonuse values is the "tree killing" experiments of Boyce *et al.* [1989] [1991]. For present purposes, the aspect of this study that is of interest concerns the use of an incentive-compatible auction institution⁴⁵ to elicit WTA and WTP for a

⁴³ McConnell [1983] and Freeman [1992] suggests a means for explaining to subjects a set of circumstances that would preclude their use of a resource which is consistent with economic theory: assume that prices for goods that are necessary complements to the good are so high as to preclude use ("choke prices.") We evaluate this approach in Section 2G, A Formal Decomposition of Total Values into Use and Nonuse Components. It was not employed in the studies discussed here, however.

⁴⁴ For the existence value one must assume that subjects accepted the distinction between household and ecological effects attributed by the researchers to the additional regulation.

⁴⁵ We question the *strength* of the financial incentives that were used in this experiment in Section (continued...)

Norfolk Pine tree, which is a little house plant. In one set of experiments, subjects were told that if they did not buy the tree (the WTP case) or sell it back to the experimenter (the WTA case), the tree would be destroyed "then and there."⁴⁶ In another case, subjects were asked WTA and WTP for a tree, but were told nothing about the disposition of the trees left in the hands of the experimenters.

Boyce *et al.* [1989] [1991] define "existence value" (in the [1989] version of the study, "intrinsic value" in the [1991] version) as the difference between bids obtained in the "kill" case and those obtained in the "no-kill" case. They find that subjects generally offered higher WTP or WTA valuations for the "kill" case than they did in the "no kill" case. These differences are found to be statistically significant, leading to the conclusion that "intrinsic values" *associated with the trees (i.e., the environmental good)* are significantly positive.

The difficulty with this interpretation of results is that the investigators are assuming that the subject sees the difference in the treatments as they do. Thus, Boyce *et al.* [1991; pp. 20-21] acknowledge that caution must be used in attributing the values obtained in the "kill" case to nonuse values that reflect motives and preferences related to the environment:

We should point out that the exact commodity valued in these experiments could be the source of some debate. Due to the variety of definitions for intrinsic values found in the literature, it may be argued that intrinsic values is not what was captured in these experiments.⁴⁷

⁴⁵(...continued)

3, CVM Values and Real Economic Commitments. Nonetheless, this study is exemplary in at least employing some institution for eliciting total values that has known demand-revealing properties in theory.

⁴⁶ Actually the destruction took place in a separate room, but did occur at the conclusion of the experiment.

⁴⁷ They continue (pp. 20-21): "The fact that individual trees were destroyed, rather than all Norfolk Island pine trees, may have different implications than if the whole species was destroyed. Nonetheless, some element of moral responsibility seems to have been captured." This extension of their argument, and expansions in Schulze [1992; pp. 29-31], appear to relate to their discussions of WTA-WTP differences. As a justification for WTA values being large relative to WTP they argue that, in the case of WTA for allowing the extinction of a species, the individual may view his acceptance of compensation as his taking upon himself the *moral responsibility* for extinction. Such is not the case with a WTP value. Boyce *et al.* [1991] claim that this difference *may* account for WTA-WTP differences for actions related to species extinction.

Indeed, it is not at all clear that differences in bids obtained in the "kill" and "no-kill" cases are in any way attributable to intrinsic or any other values associated *with the tree*. While bids in the "no-kill" case may plausibly be taken as subjects' values for the tree, bids in the "kill" case could with equal plausibility have nothing to do with the tree *per se*, but with avoiding an *action* which subjects found disgusting or unpleasant. The extent to which the "kill" case captures total value for the tree, while the "no-kill" case captures only use value, may then be problematic.

G. A FORMAL DECOMPOSITION OF TOTAL VALUES INTO USE AND NONUSE COMPONENTS

There have been several attempts to formally define what is meant by nonuse value and to propose a conceptual decomposition of total value into use and nonuse components. The most widely cited of these are McConnell [1983], Randall, Hoehn and Meier [1989] and Randall [1991].⁴⁸ We take McConnell's [1983] work as being representative of this approach and briefly review his arguments below.⁴⁹ To anticipate the results of this review, we find that these approaches are internally consistent but impossible to render operational.

The key analytical concept underlying rigorous analyses of nonuse value has been the expenditure function. This is nothing more than the smallest amount of money that an individual would require, at given (relative) prices, to attain some specified level of utility. It views the consumer as minimizing the cost of attaining this given baseline level of utility, subject to the constraint that the consumer may purchase goods only at prevailing prices. Thus, we write this minimum level of income or expenditure as a function of prices and utility levels. If the utility level that must be attained rises, then the minimum level of income

⁴⁸ Building on results in Neill [1988], Larson [1991] presents intriguing results on the possibility of using transactions-based data to estimate total value for nonusers. The key insight here is to use the restrictions of demand theory, especially the "adding-up requirement" which derives from the observance of the budget constraint, to be able to infer nonuse values. Rather than attempting to identify private goods that are complementary to the nonmarket good in question, these results focus on finding goods that are instead Hicks-neutral. The upshot is that zero nonuse value is not *imposed* as part of the process of inferring total value, as is the case with traditional complementarity assumptions in the tradition of Mäler [1974] and Bradford and Hildebrandt [1977]. No empirical application of this approach has been published, and there is still considerable uncertainty as to the precise data requirements for implementation. Nonetheless, it raises the possibility of a more thorough comparison of CVM values with transactions-based values than has been possible in the past.

⁴⁹ Randall [1991] makes use of a curious scenario (equation 10.5a on p. 306) in which the resource exists at some initial level Q^0 but is somehow priced *out of existence* via a choke price on existence itself.

needed to attain it will rise.⁵⁰ If there is an across-the-board increase in prices, then the minimum level of income must rise if the original level of utility is to be maintained.

The expenditure function is useful because it allows one to directly define equivalent changes in income levels for some parametric change in prices or baseline utility. It is also possible to generate compensated demands directly from the expenditure function: they are simply the partial derivative of the expenditure function with respect to the price of the good in question. Thus, specifying an expenditure function for an individual gives the analyst all of the information needed to undertake cost-benefit analysis and to measure demand.

To the extent that the consumer's utility function is parameterized by some *exogenous variable*, the expenditure function will be similarly parameterized. This simple extension is of the utmost importance to understanding how one can derive a decomposition of total value into use and nonuse components. When we say that a utility function is "parameterized" by some variable, all we are saying is that if that variable changes then utility will change. Most importantly, to call such a variable "exogenous" is to say that the consumer does not have any control over it: it is not a choice variable, in the sense that food purchases are typically a choice variable.

Consider adding some resource R to the consumer's utility function. It follows that the expenditure function will be parameterized by the level of R , since the level of R affects the consumer's level of utility. McConnell [1983] carefully specifies two sets of scenarios which conceptually capture a total and a nonuse value. Use value is then simply the difference between total and nonuse value. We examine these scenarios below.

G.1 Defining Total Value

It is important to state total value from the resource in comparable terms if one is to make operational use of this decomposition. Total value is defined with two scenarios, which we will refer to as 1 and 2. In scenario 1, the resource is at some reduced level, but prices are at their baseline level. We will refer to the minimum amount of income required by the individual to maintain baseline utility with this scenario as Y_1 . In scenario 2, both resource level and prices are at their baseline level. The minimum amount of income required for the individual

⁵⁰ Strictly speaking, it will never decrease. If we assume local non-satiation and positive prices then the statement in the text is correct. We will maintain these auxiliary assumptions unless otherwise specified. See Deaton and Muellbauer [1980; p. 37ff] or Jehle [1991; p.159] for a rigorous statement of the relevant properties of the expenditure function.