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Environmental Valuation: Challenges and Practices

A Personal View

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Environmental valuation, not to be confused with environmental evaluation, is the process of putting monetary values on environmental goods and services (G&S), many of which have no easily observed market prices. Examples of environmental G&S include scenic views, coral reefs, mountain vistas, biodiversity (in general), as well as biodiversity as reflected in special species like whales, elephants, coral reefs, or plants. Environmental G&S also include many indirect processes, such as watersheds and water supply, forests and carbon sequestration or erosion control, ecosystem conservation, and maintenance of genetic material.

In order to value these G&S, economists have developed a whole "tool box" of valuation techniques. One general typology of these techniques is the following:

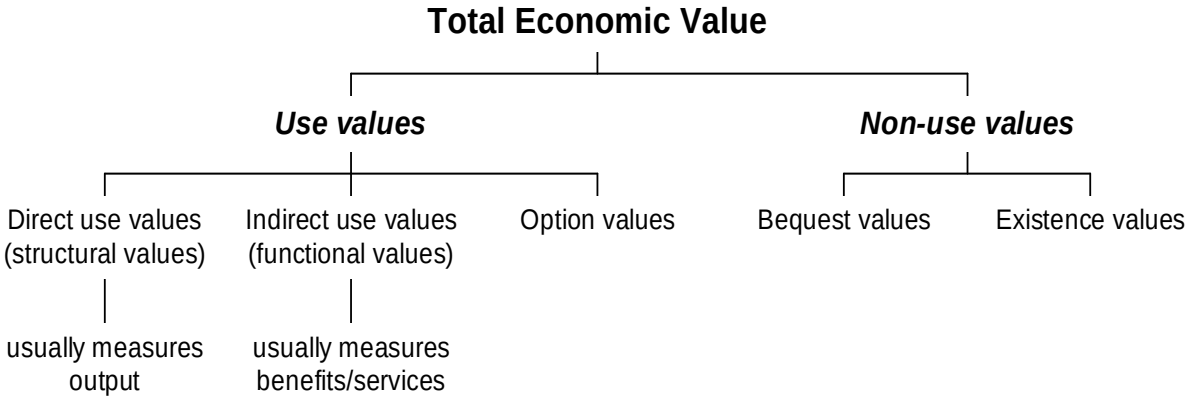
1. Techniques based on changes in production or productivity, such as in the case of agricultural lands, forestry, fisheries or human health.
2. Techniques that use survey-based information to estimate values; these "stated preference" techniques are usually referred to as contingent valuation methods (CVM).
3. "Revealed preference" techniques that use hedonic markets to estimate values; these include property value approaches and land value approaches.
4. Surrogate market approaches, such as the travel cost method (another revealed preference approach).

All of these techniques are well developed, commonly used, and quite robust. Many, even thousands, of examples exist of their use. The EVRI (Environmental Valuation Resource Inventory) developed by Environment Canada is one such listing. By use of these approaches, we can measure all or part of the value of different environmental resources.

* John Dixon, 1030 Aoloa Place, #210-B, Kailua, Hawaii, 96734; (tel) 808-261-9844; (email) johnkailua@aol.com

In this effort, one useful concept is that of *total economic value* (TEV), which explicitly recognizes that the economic value of a good or service is composed of different parts—some of which are tangible and directly used; some of which are intangible or very remote. Traditionally TEV is presented in a chart (see figure 1), where TEV is divided between *use values* (including direct use values and indirect use values, whereby the environmental goods and services provide tangible products that the present generation uses) and what economists call *non-use values*, usually defined as bequest values (what you leave to your children) and existence values (the value of knowing that something exists, even if you do not use it). Straddling the space between use values and non-use values is option value (the value to a person of having the option open for future use).

Figure 1



Challenges and Opportunities

As the economics discipline has progressed from a world where environmental values are "unknowable" or "invaluable" (a number somewhere between zero and infinity) to a world where all kinds of estimates have been made and published, and a number of challenges and opportunities exist. Economic valuation is still as much art as it is science, and one does see valuation results in correct analyses and their use, and incorrect analyses and their misuse. The following are my personal views of a number of issues in the environmental valuation "business":

A feeling by some non-economists that economics is merely price times quantity (P x Q) and that anyone can do it. This can result in the misuse of otherwise competent studies. A classic

example of this was the paper on "the value of the world's ecosystems" by Costanza et al. that was published in *Nature* several years ago. This paper relied on "benefit transfer" to apply values from valuation studies at specific locations to vast areas of ecosystems. The result was a huge value that was several times larger than the world's entire GDP. The number both overvalued many specific uses and undervalued the value of the world's ecosystems to life on earth. As one RFF researcher (Mike Toman, I believe) said, the Costanza et al. estimate "was a serious underestimate of infinity."

A trend towards "mystification" of environmental economics analyses by making them overly mathematical and opaque. This is done in the name of being rigorous and scientific (and also helps get articles accepted into the top journals). Sometimes it is done in the name of elegance. As an aside, when I was a graduate student, one of my professors, Wassily Leontief—developer of input/ output analysis and no stranger to mathematical approaches—commented on the trend toward using more and more sophisticated math in economics. I remember his response to the assertion that math was used for "elegance": Leontief replied, "I say, leave elegance to tailors!"

The overuse of certain valuation techniques and approaches is a related phenomenon. The technique that may be the most subject to overuse is CVM, the contingent valuation method. It is sometimes used when other, more direct measures, such as travel cost, may be applied. The good point about CVM is the same as the bad point—you always get an answer! It is important to realize that CVM is the only valuation technique that we have for some parts of TEV—especially for option value and the major non-use values: bequest and existence values. The NOAA Expert Panel that was set up in the 1990s after the Exxon Valdez disaster gives useful guidance on the use of CVM.

Another potential misuse of CVM is to ask the wrong question, as seen in the numerous valuation studies for different endangered species that often have the same basic value (often in the range of US$ 10 to $15 per year for the species in question). When asked to value the conservation of ALL endangered species in the world, the answer is often only marginally higher—perhaps $15 to $25. The problem is that people are being asked a willingness-to-pay (WTP) question for a specific species, when what they are actually giving is the willingness-to-pay for that class of species. A better approach would be to ask about WTP for endangered species conservation in general and then ask how this amount should be allocated among a list of endangered species.

Another valuation approach that is subject to overuse and abuse is benefit transfer—the application of results for benefit estimation from one study site to another site, the "transfer" part of the name. While this can be a useful means to carry out "quick and dirty" analyses or to value potential resource uses in a location that is yet to be developed, its appropriate use requires that a number of factors be met—the original study site and the transfer location have to have similar resources, with similar user groups and similar socio-economic backgrounds. Safari visitors or scuba divers are good candidates for this match. However, when misused, as in the case of the Costanza paper, very specific valuation studies for one specific location are then applied to large areas that are not similar in many ways, especially with respect to intensity of use. In the Costanza study, this lead, for example, to vast overestimates of certain values, such as for coral reefs or coastal areas.

Economic valuation handles small, marginal changes well, but has problems when the changes are large and non-marginal. Economics is basically a science of marginal changes—changes in a few percent in supply or demand, or in price or income. Large changes like 50 percent or more are outside what economics is designed to address, so issues like global warming, mass extinctions, or dramatic changes in pollution levels have to be handled carefully instead of merely extrapolating from results based on small changes. This will require new studies (most likely using CVM), where large changes are explicitly described to respondents and then valued (and respondents will probably have a more difficult time giving accurate answers). Economic valuation of non-marginal changes may well become an important new area for applied methodological research by economists.

There is an interesting interaction between awareness, environmental valuation, and confidence in the results. I feel that the more that people know about a resource (e.g., biodiversity, coral reefs, tropical rainforests, endangered species, etc.), the greater they tend to value those resources and the more "robust" are the valuation estimates (the lower the standard deviation around those results). Conversely, the less that is known about the resource, the lower are the estimated values and the less confidence we have in the results! In addition to frequently observing this phenomenon via casual empiricism, I first realized this in research I did with Carl Samples in Hawaii in the mid-1990s, where we found that giving students additional information on whales (in this case, seeing a short film) caused them to express statistically higher willingness-to-pay for whale conservation than a control population with the same base knowledge. This result should not surprise us, since environmental valuation is designed to reflect people's values, and those values are not intrinsic or unchangeable. Increased exposure to, awareness of, and knowledge of environmental goods and services will change values!

Four Last Thoughts on Environmental Valuation

First, economic valuation reflects people's and society's values—these values are frequently partial and imperfect. The traditional lack of markets for many environmental goods and services is now slowly changing and increasing opportunities exist for people to express their desires via market forces. These acts include donations to conservation groups, buying property with specific environmental attributes, making payments for environmental services, purchasing ecotourism trips, and demanding more environmentally friendly products. Since not all environmental goods can be turned into private markets (and the TEV approach recognizes this), the evolution of economic valuation and active markets is an important step, but not a panacea for all environmental management issues. However, the evolution of markets provides extremely useful information for improved policy making.

For example, ecotourism is big business in the Galapagos, with top dollar being paid by visitors for boat-based tours. Although the available slots (the "cupos" or berths) are set at a maximum number (about 2000) and are all allocated, one can enter the market or expand an existing operation by buying out another operation to obtain their cupos. The cost is about US$ 20,000 per cupo (equivalent to $320,000 for a 16 passenger boat's cupos) —just for the right to do business. These expressions of value are not unlike what one sees in the buying and selling of taxi medallions in New York City (reportedly up to $500,000 per medallion). The value of both cupos in the Galapagos and taxi medallions in New York reflect the fact that large economic rents are being generated in both businesses (largely created by controls on entrance to the market). Of course, in the Galapagos, the price of a boat-based tour and the associated cupos reflect only part of the willingness-to-pay by visitors for this unique resource experience. Thus, the true value of the resource is definitely much higher, but observing real markets confirms that this is a valuable natural resource.

Second, markets are still not well developed for many environmental goods and services—especially for those with long-term or diffuse impacts. One thinks of avoided climate change, coral bleaching, or chronic pollution of air or water. Because of the public-good nature of these goods and services, there are tendencies both to underestimate their importance (lack of knowledge) and understate one's willing-to-pay to address them (free-rider problems). In these cases, however, increased public awareness of and knowledge about them can increase the economic values assigned to these problems, but ultimately an appropriate response will require some policy response by governments since private markets can not handle these issue well (or at all!).

Third, many economic valuation methods are quite mature and well-tested in a wide range of situations. For some techniques, like CVM or the use of dose-response relationships and health impact valuation, they have moved from being “experimental” to business-as-usual. Except for the special case of non-marginal changes (where further refinements are probably needed), an appropriate focus for economists would be on quality applications of the tools that we have.

Fourth, a major challenge remains in translating solid research results into practical, and understandable, policy advice. This has often been a weakness and, as economists, we can do much that is useful, even if at times it may mean simplifying a message and leaving some of the elegance to tailors!