WHY IS NATURAL RESOURCE DAMAGE ASSESSMENT SO HARD?

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I. VALUING THE COMMONS

The failure of markets to allocate environmental public goods and handle externalities satisfactorily has long vexed economists. The tragedy of the commons stands in sharp rebuke to the idea that unsophisticated, privately organized markets work well enough to please Pareto. Since Paul Samuelson (1954) laid out the problem of efficient production of public goods in simple terms, the economic theory of the problem has been well understood. The work of Lindahl, Groves, and Ledyard has established mechanisms that can be used, in principle, to get consumers to reveal true values of public goods and avoid "free ridership"; see Hurwicz (1986), Werner and Groves (1993). Solutions to the allocation problem based on these theories require a sophisticated market manager and taxing authority with the information and skill necessary to administer a complex and pervasive system of specific taxes.

An important development in economics, starting with Coase (1937), is the recognition that sophisticated markets in contingent contracts, exchanged in a organizational setting that provides legal mechanisms for enforcement, can internalize many externalities, and avoid some commons tragedies. However, Coasian solutions work well only when the parties are clearly identifiable, the externality is publicly observable, and enforcement costs are not burdensome. In practice, the Coasian contract between an oil company who wants to exploit a remote wilderness, and consumers who benefit from the contribution of this wilderness to biodiversity and global air quality, requires an agent to represent consumers in the negotiation, and to monitor contract compliance. But this agent is simply the government, and the natural resource damage assessment statues and legal mechanisms in place are our practical approximation to the Coasian contract. Viewed in this way, the principal-agent problem between the government and its consumers *is* the problem, and one is led back to the issue posed by Samuelson, Lindahl, and others as to how to measure what the consumer principals truly want.

Beginning in the 1960's with the Clean Air Act, the Air Quality Act, and the establishment of the Environmental Protection Agency, and culminating with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the Oil Pollution Act of 1990 (OPA), the U.S. has put in place a body of law and an administrative system intended to regulate environmental quality, and assign liability and collect damages for environmental injury. CERCLA mandates that the damages from an injury cannot exceed the value of the lost resource to consumers. Value includes lost use, and when it can be measured reliably, lost existence or non-use value. The valuation exercises mandated by CERCLA have attracted many economists, and focused attention on valuation methods and their reliability; see Vain and Bromley (1994).

While economists have had an important role in giving policy advice to EPA, DOI, and NOAA on how CERCLA might be implemented, the real development and testing of valuation instruments is being done in the trenches, by economic experts testifying on natural resource damage assessment (NRDA) in environmental litigation. An example is the constellation of suits that followed the Exxon Valdez oil spill. The valuation problems fall into three general categories, each with an associated valuation method:

1. Direct market impacts, such as truncation of a commercial fisherman's season due to an oil spill, or the reduction of a homeowner's selling price due to ground water contamination from a nearby superfund site. The associated valuation method is the <u>hedonic price method</u> (HPM).

2. Use losses, such as loss of recreational fishing opportunities, that do not have direct market prices, but can be priced indirectly through measurement of market cost of complementary consumption; e.g., the cost of travel to recreation sites. The associated valuation method is the <u>travel cost method</u> (TCM).

3. Existence or non-use losses, such as the value placed on preservation of remote wildernesses, off-shore birds, or genetic diversity. The associated valuation method most commonly used by resource economists is the <u>contingent valuation method</u> (CVM). CVM is one case of a variety of <u>preference scaling methods</u> (PSM) used in psychology and market research. In principle, PSM can also be used to value direct market impacts or use losses; this can provide indirect evidence on the reliability of PSM for valuation of non-use losses; see Bishop et al (1983), Cameron (1992), Siep and Strand (1992).

There are a number of cases in which HPM or TCM have been used to determine damages, and it is possible to make an overall assessment of the reliability of these methods *as they are actually used in litigation*, and their acceptance by the courts. CVM has yet to have a complete legal test, but is controversial enough so that I expect the courts to embrace it quite gingerly.

Does the track record of economists in natural resource damage assessment represent a triumph of economic analysis, yielding the Coasian ideal and bringing credit to our profession? I believe to the contrary that the glaring lack of consensus among economic experts is embarrassing, and if widely publicized, would give the profession a black eye like the one that came from the macroeconomic forecasting fiasco at the beginning of the 1970's. In the grand American tradition that if something goes wrong, it's someone else's fault, I will try to assign blame for these results. The economic expert stands between the consumers and the lawyers, translating information from the former into the damage dollars sought by the latter. Thus, it is natural to dwell on the shortcomings of lawyers and of consumers. Unfortunately, it is necessary to also consider the shortcomings of economists, at least the ones other than you and me.

Let's start with the lawyers; that is, the legal system for determining damages. Does the legal system create incentives for economic experts to compromise good scientific practice? I believe the answer is YES. I am going to use a little stylized model and a couple of strong assumptions to make my point. Suppose the plaintiff in a natural resource injury case says the damages are P and the defendant says they are D. Assume that the court forms probabilities that these claims are "valid", and awards damages by weighing the claims of the parties by these probabilities:

$$A = \frac{P\cdot\pi(P) + D\cdot\pi(D)}{\pi(P) + \pi(D)} ,$$

where A is the damage award, and π is the probability that a claim is judged to be valid. Assume that π is largest at the true damages T, and falls toward zero as claims deviate more from T. The less reliable an available method for estimating damages, the more difficult it is to detect errors, and the more slowly π falls as one moves away from the true damages T. The goal of the plaintiff's lawyer is to maximize A, and the defendant's lawyer, to minimize A. Figure 1 illustrates the damage award as a function of the claims of the two parties. The Nash solution to this game, at a saddle point of the award function, will never lead the parties to claim the true damages. Rather, the plaintiff will overstate the claim, increasing P to a margin greater than T where

$$(P - A)\cdot\frac{\partial \log \pi(P)}{\partial P} = -1 \ .$$

Similarly, the defendant will understate the claim, decreasing D to a margin less than T where

$$(A - D)\cdot\frac{\partial \log \pi(D)}{\partial D} = 1 \ .$$

A numerical example illustrates the solution to this game. Suppose

$$\pi(X) = 1 - (\log(X/T)/\sigma)^2 \ ,$$

where σ parameterizes the degree of uncertainty regarding the true damages T. This probability function has the property that claims that are half or double the true value have equal probabilities of being valid. Figure 1 was constructed using this probability function, T = 1, and σ = 1. At this σ, a claim that is double the true value has probability 1/2. At the Nash solution for this case, the plaintiff's claim is 1.76 and the defendant's claim is 0.57; these claims differ by a factor of 3. Figure 2 shows the claims and awards, relative to true damages, for various σ. In this example, the asymmetry of claims, which are bounded below by zero and unbounded above, and the symmetry of validity judgments in terms of percentage errors, combine to produce awards that exceed true damages. The main point of this graph, however, is that the claims of the parties fan out rapidly as uncertainty about true damages rises. Even moderate uncertainty can induce claims that differ by an order of magnitude.

Now, each party retains an economic expert. By definition, and by law, an expert is a disinterested professional who opines on the value of T, or on the value of π for various claims. It is improper for lawyers to suggest testimony to experts, or invite opinions to support the client's claims. Professional integrity is supposed to be enough to guarantee that the expert will not support claims that deviate from T. However, moral fiber is strongest when it is not cut by self-interest, and experts face powerful incentives to advance their client's case. The expert is an agent of the client, and depends on the client for continued employment. Any lawyer worth his fee will work to "capture" his expert with persuasive arguments that his own positions are conscientious and reasonable, and his opponent's positions are absurd and unconscionable. Experts will not be asked to analyze questions whose answers the lawyer expects to be unhelpful to the client. Finally, if an expert proves too recalcitrant, then the lawyer can simply switch experts. Even in an ideal world where all experts were impervious to the blandishments of lawyers, but had honest differences of opinion because of the way they approach problems or the tools that they use, lawyers could sample from the experts to find those whose opinions they find useful.

In academic debates, scholars deviate from the truth at their peril, since their arguments can be replicated and tested, and their peers judge misbehavior harshly. However, there is no effective arena in which economists appearing in legal proceedings are held accountable for their conduct. If anything, there is a backhanded admiration for rogues who excel at the sport of expert testimony, and are determined to win at any price. If courts fail to discriminate between rectitude and roguery, then lawyers opt for rogues, and bad experts drive out good. Reputation may matter, and experts who make inconsistent or demonstrably false arguments reduce the probability of continued employment. However, effective defense of a client in a case where the claims of the parties are in serious disagreement will enhance the expert's reputation in legal circles, even if the scientific foundation for the defense is weak.

What are the implications of all this? From the viewpoint of the courts, and occasionally the public, the scatter of damage estimates appearing in litigation suggests that economic experts are either incompetent or venal. From the viewpoint of economists, "venal" is a harsh word for rational response to incentives. Further, if incentives are responsible for the observed scatter, then one is not forced to conclude that the measurement methods employed are intrinsically unreliable. What about changing the incentives that lawyers and their experts have to overstate their cases? Those of you who know the literature on collective bargaining will recognize that my stylized description of how courts referee damage cases closely parallels models of labor arbitration, where divergent claims appear for the same strategic reasons. That literature suggests some alternatives for conflict resolution, such as final offer arbitration, that reduce strategic incentives for misrepresentation. One could also imagine the use of expert referees or masters to advise the court on the plausibility of claims, or modifications to the discovery procedure that make it easier for opposing experts to iron out differences. While the legal system is unlikely to adopt major changes, parties in conflict could certainly use such mechanisms. Second, I think there is a case for making economic experts more professionally accountable. For example, one might establish standards and certification of experts, and subject their performance to periodic review. I proposed this to the executive committee of the American Economics Association, which was shocked, shocked by the suggestion that some expert work by economists is shoddy, or that a professional society might take some responsibility for professional standards. Nevertheless, I believe that questionable conduct by economic experts damages the professional reputation of us all, and more seriously, damages efficient and fair resolution of legal disputes.

Beyond the question of the conduct of economic experts, and the incentives that our legal system creates to compromise professional judgment, there is a substantive issue as to whether economists are asked valuation questions that have answers, or are trained to analyze these questions in ways that provide answers. Consider the aphorism: "Economists know the price of everything, and the value of nothing." Of course, this is factually incorrect. We don't know the price of everything. However, this saying reveals the soul of the economist. Almost all of economic thought, and economic training, thinks of value as something that can and should be priced, and in well-operating markets, is priced. We are very uncomfortable with the idea that there might be more effective or acceptable ways to map values to public policy than through pricing of benefits and costs, or that values may be too context-dependent and impermanent to be reliably priced. When we are faced with a task of direct measurement of values, our solution has been to create a hypothetical market, where we can record asking prices for an environmental resource just like we would investigate the value of a loaf of bread.

The economist's penchant for looking at the consumer through market glasses makes sense if the consumer cooperates. However, as those of you who do contingent valuation studies know, consumers are anything but cooperative, producing a dazzling array of endowment, anchoring, and embedding effects that confuse the economist's simple notion that if you ask for a reservation price, you get it. Most economists have thought of these effects as a *software* problem: If we can get the bugs out of our measurement instruments, clear the field of the incompetent operators, and get some real money up front so the consumer has the right incentives, then these effects will disappear, and we can read off the values that we need. In this view, the consumer is simply an uncooperative witness, indifferent to the truth and fixated on irrelevances. The measurement task is difficult, but not impossible: True preferences will be revealed if we get the consumer's full attention, provide all the relevant information, and create incentives that make prevarication costly.

The alternative is that we have a *hardware* problem: consumers are wired differently than the economic model of fully formed, stable, rational preferences requires. While the consumer's wiring may produce patterns of market behavior that will often be approximated well by the economist's model, when we approach the consumer from a different angle, asking direct and unusual questions about values, we find alarming variations from the standard economist's story. All these consumers, so normal and rational on the outside, are revealed to be shells filled with vast rule-books of heuristics written by natural selection. Throw these people a curve ball, in the form of a valuation question that fails to fit a standard heuristic for market response, and the essential mindlessness of the organism is revealed. For most economists, this is the plot line for a really terrifying horror movie, a heresy that cuts to the vitals of our profession. Nonetheless, it may be true.

II. DIRECT MARKET IMPACTS AND THE HEDONIC PRICE METHOD (HPM)

Direct measurement of market impacts is a domain where economists should be completely comfortable, and where you might expect only modest disagreements between opposing experts. The idea of estimating damages using the hedonic price method is simple: If properties A and B are identical except that A's are affected by an environmental injury and B's are not, and A's sell at lower prices than B's, then the owners of A's are damaged by the amount of the price difference. It is not much more complicated to allow for the possibility that A's and B's differ in observable ways unrelated to the injury, but the contribution of these additional factors can be removed statistically by the hedonic regression method. Nevertheless, in damage cases involving HPM, I have seen expert's estimates of damages differ by an order of magnitude. For example, in the lawsuit over commercial fishing losses following the Exxon Valdez oil spill, the plaintiffs claimed the damages were $900 million; the defendant claimed they were $100 million. What is going on? Is economic measurement so unreliable, even in this classical arena of market price, that it can provide no more guidance than this to the courts? Or, did Paul Samuelson have it right when he said "Economists are like water spaniels; they are loyal to the person with the dinner dish." I believe the answer is that the measurement problem here is in fact quite subtle, offering many opportunities to shift the tiller in ways that are not transparently wrong, but end up leading the expert to sail in the direction that benefits the client.

The first subtlety comes in choice of the control B's. Pick ones too remote from A's in space or time, and unmeasured factors other than the injury may contribute to observed price differences. Pick B's too close to A's, and the B's may not be free of the effect of the injury. Then you are measuring only the <u>added</u> damage suffered by A's over B's, not the total damage. In the Exxon Valdez case, half the plaintiff's damages came from declines in fish prices that the plaintiff attributed to reputation effects from the oil spill and the defendant attributed, more convincingly to the court, to the growth of fish farming. This is an example of disagreement on the appropriate B's.

The second subtlety comes in specification of the hedonic regression. The basic idea is to run a regression in which the selling price of A and B properties is explained by proximity to the injury and factors unrelated to the injury,

$$\left[\text{Log Sales Price}\right] = \begin{bmatrix}\text{Proximity to injury}\\ \text{e.g., indicator for A}\end{bmatrix}\cdot\alpha + \begin{bmatrix}\text{Hedonic attributes}\\ \text{e.g., number of bedrooms}\end{bmatrix}\cdot\beta + \varepsilon\ .$$

The coefficient α estimates the loss in value arising from the injury, provided all the classical assumptions for regression analysis are satisfied. However, omit a factor, perhaps one that is hard to measure or summarize, for which B's are better than A's, and you increase the estimate of damages. Include a factor that is influenced, perhaps obscurely, by the environmental injury, and you incorrectly attribute part of the true damages to this factor. I will illustrate with two examples from a superfund site stigma case. The proportion of houses with concrete curbs and driveways, rather than tarmac, turned out to be higher among the B's than the A's. When an explicit variable was added for this, its coefficient was close to the added construction cost of concrete, and the damage estimate fell substantially. On the other hand, the coefficient on a dummy variable for city-supplied water was positive, but smaller than one might expect from external evidence on willingness to pay for city services. It turned out that city water had been installed selectively in areas where ground water contamination from the superfund site was an issue. Then, this coefficient may have been smaller than it should have been because it was capturing part of the effects of the injury on price.

From these observations, I conclude first that there can be substantial variation in damage estimates due to errors that are difficult to anticipate or to detect. Even honest experts may be driven by the prevailing winds to substantially different conclusions. In an academic setting, false starts and differences of opinion are viewed, properly, as part of the process of groping toward a better understanding of how the analysis should be done. In the hands of lawyers, they become divisions that retard conflict resolution and damage the reputation of the economics profession. Add to this a few rogues, a lack of professional standards, certification, or accountability, and lawyers who shop for the opinions they want, and you have all the ingredients required to make economists look bad.

III. USE DAMAGES AND TCM

Often, environmental goods such as recreation are not priced through user fees, but are indirectly priced through the cost of complements to their consumption. Specifically, recreation usually involves travel, and there are travel costs and time expended in transit and at the recreation site. Then, travel costs and the opportunity cost of time represent an indirect price for the recreational activity. The idea of estimating damages from an environmental injury is this: If site A is injured and site B is not, and in the absence of injury the two sites would be identical, then the added indirect price consumers incur to go to B rather than A is an indicator of the damages from the injury to A.

The calculation of damages is conceptually simple. Suppose consumers with identical tastes live along a highway between A and B, as shown in Figure 3. Absent injury, they would choose the closest recreation site, splitting half way between. In the presence of injury, the extensive margin D reveals the loss in value from the injury for any consumer who goes to A, since the consumer at D is just willing to incur the generalized travel cost difference TC_{DB} - TC_{DA} to avoid it. Consumers living between D and 1/2, such as the consumer at X incur a smaller loss, TC_{XB} - TC_{XA}, because of the availability of the substitute at B. The damages are the sum of these losses, except for some subtle adjustments that may be needed to handle income effects consistently.

Figure 4 pictures this calculation in a way that is more familiar to economists. Think of the demand for A as a function of its indirect price. Represent the removal of the injury as an equivalent reduction in the indirect price, with a concomitant increase in demand. Then, the damages equal the area behind the demand curve, the classical (Hicksian) consumer's surplus.

Actual implementation of TCM is more complicated for both theoretical and econometric reasons. First, there is clearly taste variation in the population, as different individuals facing the same menus of recreation alternatives make different choices. Then, the theory of equivalent and compensating variations that provides the foundation for consumer surplus measures of loss must be generalized to accommodate unobserved heterogeneity in tastes. This is mostly straightforward, but some subtle assumptions are required on how unobserved taste factors don't interact with income or with the injury; see McFadden (1995). Second, there are significant econometric problems in collecting data on actual recreation behavior, specifying a model that is consistent with consumer theory and does a good job of representing behavior, and testing and validating the model. Current generation recreational demand studies use sophisticated survey methods, random utility choice models that are sufficiently flexible to track most patterns of substitutability, and explain both participation and site selection, and the full battery of contemporary econometric methods for estimation and specification testing. Nevertheless, this is a sufficiently complex and subtle exercise so that even very good economists can slip up, and do. There may also be genuine disagreements on the best assumptions or procedures.

I will give two examples that illustrate how difficult it can be to implement the TCM correctly. First, in sampling a population of recreators to obtain data on their behavior, it is tempting to intercept them at recreation sites rather than using a household-based random sample. This would assure adequate numbers of visitors to injured and control sites, and be much more efficient at finding recreators than a random sample. However, frequent recreators have a higher probability of being captured in an intercept sample than infrequent ones, and consequently attributes associated with high frequency are oversampled. Subtle modifications in econometric estimation procedures are required to ensure that this oversampling does not distort parameter estimates or the damage estimates that flow from them. In a recent paper (McFadden, 1996), I describe some surprising statistical complications that arise when one analyzes data from a panel of recreators formed by interception.

Second, application of random utility theory in TCM requires that one parameterize the indirect utility of a recreation visit. The usual form is something like this:

$$\begin{bmatrix}\text{Indirect Utility}\\ \text{of a Site}\end{bmatrix} = \left\{\begin{bmatrix}\text{Disposable}\\ \text{Income}\end{bmatrix} - \begin{bmatrix}\text{Travel}\\ \text{Cost}\end{bmatrix} - \begin{bmatrix}\text{Dollar Value}\\ \text{of Time Used}\end{bmatrix}\right\}\cdot\beta$$

$$+ \begin{bmatrix}\text{Degree of}\\ \text{Injury}\end{bmatrix}\cdot\alpha + \begin{bmatrix}\text{Hedonic Attributes}\\ \text{of the Site}\end{bmatrix}\cdot\gamma + \varepsilon$$

The degree of injury may be measured by an extensive variable, such as fish abundance for anglers, or by a dummy variable that is one for injured sites and zero for control sites. A consumer's WTP for elimination of the injury is obtained as follows: If the consumer visits an injured site despite the injury, he incurs the full impact of the injury, and his WTP for a change in the degree of injury is the ratio α/β times the change. If a consumer visits an injured site only after the injury is eliminated, his WTP is less, since he was sheltered from the full impact of the injury by use of a substitute. The exact WTP calculation depends on the behavior of the disturbances ε; in multinomial logit and nested multinomial logit models, these calculations are enshrined in what are called log sum formulas. The economic substance is that this is a consumer surplus calculation, estimating the area behind the demand curve for the injured sites between their equivalent prices for the injured and non-injured states.

As in HPM, there are subtle econometric issues in the handling of hedonic site attributes other than the degree of injury. If attributes that are correlated with the degree of injury are omitted, then the coefficient α spuriously attributes their impact on behavior to the injury. On the other hand, included attributes whose levels are influenced by the injury will capture part of the overall effect of the injury, and may not be handled appropriately when the damage calculation is done.

Consider the term involving income, travel cost, and travel time. The level of the estimated coefficient β, which is inversely proportional to the level of damages, depends on how travel costs are measured and how travel time is handled. Economic theory is clear: Travel costs should include all components that vary at the margin with recreational choices, and time spent traveling to and engaging in recreation should be valued in terms that reflect the individual's opportunity cost of time At this point, the complications start.

Individuals value time spent in different activities differently. In-vehicle travel time is not as onerous as working for most people, and they value it at a substantial discount relative to their wage. Another way of saying this is that travel time to a recreation site conveys some benefits that offset the opportunity cost of wages foregone. For time spent actually engaged in recreation, this offset may be complete. The structure of indirect utility is most easily seen by starting from the direct utility associated with a fixed recreational choice,

$$\begin{bmatrix}\text{Direct utility}\\ \text{of a site}\end{bmatrix} = \beta\cdot c + G(h + (1\text{-}\psi)\cdot TT + (1\text{-}\lambda)\cdot RT)$$

$$+ \begin{bmatrix}\text{Degree of}\\ \text{Injury}\end{bmatrix}\cdot\alpha + \begin{bmatrix}\text{Hedonic Attributes}\\ \text{of the Site}\end{bmatrix}\cdot\gamma + \varepsilon \ ,$$

where c is consumption, h is hours of non-recreational leisure, TT is travel time, RT is on-site recreation time, and G is an increasing concave function. The coefficient ψ is less than one, reflecting the fact that recreational travel is less onerous than working, and the coefficient λ is near zero, reflecting the fact that recreational activities convey approximately the same gross benefits per hour as other forms of leisure. (If the consumer can optimize the allocation of time between recreation and other leisure, then λ should be zero.) The consumer will choose c and h to maximize this expression subject to the budget constraint $N + w\cdot l = OPC + IVC + c$ and the time allocation constraint $H = l + h + TT + RT$, where N is non-wage income, w is the wage rate, l is hours worked, OPC is out-of-pocket travel cost, IVC is the variable part of indirect vehicle cost (e.g., depreciation and maintenance due to "wear and tear"), and H is total time available. Define $H^* = H - \psi\cdot TT - \lambda\cdot RT - l$. This problem is solved by an increasing function $H^* = g(\beta w)$ that satisfies $\beta w \equiv G'(g(\beta w))$, and correspondingly $l = H - \psi\cdot TT - \lambda\cdot RT - g(\beta w)$ and $c = N + wH - w\cdot g(\beta w) - OPC - IVC - \psi w\cdot TT - \lambda w\cdot RT$. Substituting these in the direct utility function gives

$$\begin{bmatrix}\text{Indirect Utility}\\ \text{of a Site}\end{bmatrix} =$$

$$\beta\cdot\Big\{[G(g(\beta w))/\beta + N + wH - w\cdot g(\beta w)] - OPC - IVC - \psi\cdot w\cdot TT - \lambda\cdot w\cdot RT\Big\}$$

$$+ \begin{bmatrix}\text{Degree of}\\ \text{Injury}\end{bmatrix}\cdot\alpha + \begin{bmatrix}\text{Hedonic Attributes}\\ \text{of the Site}\end{bmatrix}\cdot\gamma + \varepsilon\ ,$$

where the term $G(g(\beta w))/\beta + N + wH - w\cdot g(\beta w)$ is disposable income. Econometrically, this implies that one needs to distinguish travel time components, and distinguish individuals who may weigh different components differently. In a carefully designed experiment where travel time components are very precisely measured, and trips vary enough so that one can distinguish the influence of the different components, one can do a good job of estimating behaviorally what consumers' weights are. In a recreation model developed for litigation, is will often be difficult to duplicate these conditions, and it may be quite difficult to get sensible estimates of the consumer's weights.

Travel cost also causes difficulties. Economic theory says a marginal dollar is a marginal dollar, independent of the category in which it is spent. However, consumers fail to cooperate, and instead pay more attention to visible travel cost dollars, such as out-of-pocket gas and lodging expenses, than they do to less visible costs such as the variable components of maintenance and depreciation; see Hensher (1985), Manering (1983), Manering and Winston (1985), Small (1983) and Train (1986). The observed behavior appears to arise because people keep different categories of expenditures in different mental accounts; see Thalor (1990). In the utility formula above, replace IVC by $\kappa\cdot\mu\cdot IC$, where IC is average indirect cost (including both fixed and variable components), μ is the fraction of average indirect costs that are variable, and κ is a behavioral parameter. If the parameters α, β, μ, and κ were known, should one calculate damages in terms of high-powered out-of-pocket dollars (e.g., multiplier α/β), or in terms of low-powered indirect cost dollars (e.g., multiplier $\alpha/\beta\cdot\kappa\cdot\mu$)? For the conceptual experiment of calculating the equivalent variation in non-wage income N that keeps the consumer at the utility level with injury when the injury is removed, the answer is that one should use high-powered dollars. There is also a legal argument for this alternative: Under tort law, a plaintiff is not entitled to damages that could reasonably have been mitigated. By this yardstick, the consumer is not entitled to the extra damages that would result from collecting them in low-powered dollars, since these extra damages are easily mitigated by collecting the damages in high-powered dollars.

Econometrically, one would like to estimate the travel demand model as a function of OPC and IC to obtain consistent estimates of both β and $\beta \cdot \kappa \cdot \mu$. In practical travel demand analysis, OPC and IC are nearly collinear, as the detailed vehicle information necessary to measure relative variation in these variables is not collected. Then, it is necessary to use an external estimate of $\kappa \cdot \mu$; popular choices are zero and one, while consensus estimates from the travel demand literature are roughly $\mu = 0.3$ and $\kappa = 0.4$. At current price levels, OPC and IC are both about 14 cents per mile. If the estimates above are correct, then omitting IC from the analysis ($\kappa \cdot \mu = 0$) biases the damage estimate downward by 12 percent, while combining OPC and IC into an overall average cost ($\kappa \cdot \mu = 1$) biases the damage estimate upward by 100 percent.

There is a more fundamental issue raised by the way consumers deal with costs. Consumers are giving us a look that raises questions about the soundness of the rationality assumptions underlying consumer surplus calculations.

What are the implications of these observations? First, TCM is hard. There are tough questions about how to draw samples, define variables, design models, and carry out estimation. Errors are going to be made. Experts need to resist the pressure from lawyers to be consistent even when consistently wrong. They need to resist the bipolarity of legal language: good or bad, reliable or unreliable, valid or invalid, and concentrate more on the process of damage estimation, identifying elements that need correction and demonstrating how they should be corrected. The courts need to be educated that a process in which the work of an expert is critiqued by reviewers, and mistakes corrected, should not be interpreted as impugning the qualifications of the expert, but rather as enhancing the quality of the expert's final damage estimate. The courts need good technical help, through masters or some similar mechanism, to distinguish between genuine scientific ambiguities and subtle errors. Journal refereeing provides some lessons for the appointment of technical masters. Referees can detect errors, but can also add noise to the process; selection of referees who identify intellectually with the experts invites bias, but referees who are too distant from the analysis may miss essential distinctions. Having several referees helps. Finally, parties interested in resolving a conflict should be encouraged to seek forums in which their respective experts can bounce off each other and resolve differences, rather than preserving these differences as ammunition to attack each other's claims.

IV. EXISTENCE VALUES AND CVM

The last major class of potential damages are those that arise because consumers may care about environmental injury even though it has no direct measurable impact on their market transactions or their behavior. For example, it bothers me that baby seals are clubbed for fur coats, even if you tell me that seals are fecund enough to achieve a maximum sustainable population, and the alternative to clubbing is slow starvation or quick consumption by a polar bear. I value the Brooks wilderness because I feel that establishing green lines that limit human exploitation of the environment will benefit humans and other species in ways that I may not even be able to anticipate. However, when I turn as an economist to ask how these feelings should be mapped into damages, three very big questions arise:

1. Do the legal statues on environmental damages intend that damages be awardable for such feelings, and should they?

2. Can CVM, which attempts to value these feelings by pricing them in hypothetical markets, do so with sufficient reliability to make the damage estimates acceptable to the courts; have we solved the "software problem"?

3. Do these feelings conform to the economic model of rational preferences, so that we can even hope to measure them reliably, or do we have a "hardware problem" that will require us to abandon the consumer surplus approach and take an entirely different tack to translating existence issues into public policy and legal damage awards?

Consider first the question about the scope of environmental damages. I note that there are injuries that are not compensable under common law. If a drunk driver knocks down my fence and injures my neighbor's child, I will suffer far more for the child than for the fence. Nevertheless, while the law allows me to recover the cost of the fence, it does not permit me to recover for the pain I feel for the child's injury. Almost all economists would agree that this is an aberration, since a loss of utility is a loss of utility, whatever its cause, and in an ideal Coasian world, a contract would cover this contingency. The natural question to ask is why the law disallows such obvious claims. It is likely that these claims would overwhelm the court system because they are so pervasive and so hard to measure and verify. Then, self-preservation may be the primary motivation for courts to exclude them. This is not a good thing, but it is an understandable thing. An economist given the task of designing a resource allocation mechanism that includes a costly court system might well adopt such a policy.

There is a second, more subtle issue. Part of my pain from the injury to the child comes from my sympathy for my neighbor's pain. Should my loss as well as his loss be compensated, or is that double counting? In a world with altruism, how far should damages spread? These are not easy questions, even for an economic philosopher, and perhaps we should not be surprised that the courts avoid them.

There is a third consideration that should concern economists. The biggest <u>economic</u> impacts of alternative damage rules comes through their *ex ante* deterrence of socially undesirable conduct, rather than through the *ex post* redistribution of resources following injury. Economists need to consider carefully whether existence values have to be included in environmental legislation to get the deterrence incentives right, and if so whether this is best handled by awards based on *ex post* valuation, or some alternative mechanism.

The relevance of this discussion to existence values for natural resources is obvious. Even if economists agree they are as natural a component of damages as lost use or lost market opportunities, the profession will first have to persuade itself that these values can be measured reliably, and then persuade the courts that these valuations can be used in awarding damages without creating a morass of litigation; see Bromley (1995); Brookshire and McKee (1994); Cummings and Harrison (1994); McManus (1994).

What about the performance of CVM as a measurement tool? Can it be used to attach a reliable value to the existence of a natural resource, such as a pristine Prince William Sound? This is an issue of great controversy, but there is one fact that are beyond dispute. Consumer's responses to hypothetical market questions are markedly sensitive to the context in which the questions are framed, in ways that are not consistent with simple revelation of true preferences. This shows up as <u>endowment effects</u>, in which there is a big gap between willingness to pay (WTP) and willingness to accept (WTA), whatever the starting point; in <u>embedding effects</u>, in which consumers apparently do not account properly for the scale of the resource; and <u>anchoring effects</u>, in which responses are sensitive to cues contained in the question; see Bishop and Heberlein (1979, 1986, 1990), Bishop, Heberlein, and Kealy (1983); Boyle, Bishop, and Welsh (1985, 1993); Boyle (1989); Carson et al (1994); Cooper and Loomis (1992); Desvousges et al (1992); Diamond (1993); Diamond and Hausman (1994); Folmer and van Ierland (1989); Gregory and Furby (1987); Harrison (1992); Holmes and Kramer (1995); Hutchinson et al (1995); Johnson et al (1990); Kahneman and Knetsch (1992); Kealy and Turner (1993); Loehman et al (1994); McFadden (1994); Schultze et al (1994); Silberman and Klock (1989). Some CVM practitioners have argued that these effects appear in natural resource valuation solely because of poor survey techniques of critics who fail to follow the "one true way". In fact, these effects are not specific to CVM for natural resource valuation, but are present in a broad range of survey and laboratory settings, for both valuation tasks and objective estimation tasks.

For example, in a recent paper (Green et al, 1996), my coauthors and I have investigated anchoring to bids in both valuation and estimation tasks. We find that not only are there comparable effects for the different tasks, but that one can almost see a consistent pattern to anchoring that is task-independent and might form a basis for being able to predict and undo the effect. Figure 5 illustrates the distribution of responses to the question "How high is the tallest redwood?" One sample was asked for an open-ended response. The second sample was prompted by initially asking "Is the highest redwood higher than X?", followed up by the question "How high do you think it is?", where X was an anchoring bid selected to correspond to a quantile of the distribution of unprompted open-ended responses. The figure shows that the distribution of responses is substantially shifted toward the anchor. Qualitatively similar effects are found for other estimation tasks and for contingent valuation tasks. Figure 6 compares the effect of anchoring across tasks; the finding is that anchors placed at comparable quantiles of the distributions of open-ended responses for different tasks have comparable anchoring effects.

Another example of this phenomenon occurs in a panel of elderly households that is being surveyed by the University of Michigan for the National Institute of Health. People are asked for the balance in their savings accounts, or prompted by unfolding brackets. An experimental module reveals that the bracket questions anchor responses. The effects are large enough to make a substantial difference on economic conclusions about the assets of elderly households, and follow essentially the same pattern as the laboratory valuation and estimation experiments.

The experiments on anchoring flag a measurement issue that CVM must deal with, and suggest some techniques that might be used to mitigate or correct the effects of anchoring. More fundamentally, they make the point that consumers' responses are veiled by context effects, and until these effects are substantially under experimental control, CVM results are likely to be unreliable.

An issue frequently raised in CVM is the realism of hypothetical market experiments and the role of incentives. If the subject views the question as purely hypothetical, with no link from response to policy, then there are no positive incentives to be truthful, and one may obtain "opinion poll" responses distorted by extraneous considerations, or by a disconnect between value and budget dollars. If the subject does think response may be linked to policy, then the CVM format may be incompatible with truthful revelation of values.

Consider the environment and thought processes of a consumer engaged in a private goods purchase, say a camera. The commodity is a concrete good that the consumer can handle. The camera buyer will *actively* search for information on alternatives, through photographic or consumer magazines, discussions with friends and sales people, and inspecting the cameras. The depth and duration of search for information and the order in which it is assembled are all under the consumer's control. An inexperienced consumer who has little familiarity with cameras is particularly likely to seek information from more experienced friends. The search environment involves *social interaction*, and in many channels is *visual* and *aural* rather than written. One might say that the consumer goes through a process of *constructing* preferences for cameras. While a classical economist might bridle at the idea that preferences are constructed, rather than innate and immutable, the presence of learning, and the dependence on history that learning implies, is neither inconsistent with rationality nor with benefit-cost analysis.

In contrast, consider a typical CVM experiment, say the question of saving sea birds from minor oil spills. The commodity is unfamiliar to most consumers, at least in the context of setting levels of consumption and payment, complex, and abstract. The consumer is a passive recipient of a linear, often brief, written or verbal description of the commodity, with limited opportunity for questions or discussion in a social setting. Response is required in an abbreviated time frame. As in the purchase of a camera, learning and construction of preferences is likely to occur, but the time frame, poverty of information, and lack of economic incentives may be more likely to lead to protocols for this construction that are inappropriate; see Schkade and Payne (1993, 1994); Whittington et al (1992). I would not be surprised if consumers forced to purchase cameras under the time and information conditions typical of CVM behaved differently than consumers in the actual camera market. Then, I believe we should not be surprised if CV valuations of environmental public goods appear unrealistic when held up to the yardstick of real market behavior.

Consider the incentives that are present, or might be induced, in CVM. It is useful to view a CV elicitation on the value of a public good as a *game* in which a rational economic subject will choose a response that maximizes expected payoff. This behavior will take into account the distribution of possible costs of supplying the good. Conditioned on these costs, behavior will be determined by the mapping from costs and response into the payment required if the good is supplied, and the resulting net benefit, and the probability that the response is *decisive* for provision of the good (Palfrey and Rosenthal, 1994). Three aspects of the CV game are the *elicitation format* (form of the requested response), the *implementation frame* (link between survey response and the subjective probability that the policy will be implemented), and *payment vehicle* (form in which payment is specified, the condition under which payment would be required, and the link between response and potential payment). A *decisive* implementation frame prompts the belief that the probability that the policy will be implemented depends on the subject's response; i.e., the subject is induced to believe that there is a positive probability of being the deciding voice. A *decoupled* payment vehicle states that *if* a good is provided, then its cost will be distributed across all consumers by a formula (such as an income tax surcharge) that does *not* depend on the subject's CV response. Then, the CV response can affect *only* the probability that the good is provided, and *not* the payment level required if the good is provided. The decoupled payment vehicle is usually paired with a referendum elicitation format in which the consumer is asked if he is willing to pay an amount X for the good.

Most CV studies have *not* used a decisive implementation frame, so subjects should treat questions as purely hypothetical. Then, there are zero *economic* incentives for either truth or misrepresentation. Factors outside the economic model, such as the convenience of either truthful or conventional responses, or the motivations that influence stated attitudes in pure opinion polls, may affect response to the CV elicitation in this case. The greatest danger is probably not deliberate misrepresentation of preferences, but rather carelessness in translating values into dollars.

In principle, CV experiments can be given decisive implementation frames. A referendum elicitation format is made decisive by prompting the belief that the probability of implementation is positively related to the survey plurality, or to the probability of a majority vote, at the policy's actual cost. To accomplish this in an open-ended elicitation, the surveyor must persuade the respondent that his response will be counted as a "Yes" if it exceeds actual cost, *and* that the probability of implementation is linked to survey plurality. Money payments are not required to make an implementation frame decisive, but may increase the saliency of decisiveness.

Suppose a subject believes that the probability of implementation, conditioned on actual cost c, is proportional to the survey plurality for the good at this cost. Let r denote the subject's response, which in an open-ended format is stated WTP and in a referendum format is the largest bid at which the subject will give a "Yes" response. Suppose the subject believes the linkage between response and prospective payment is given by a function $h(c,r)$. For a decoupled payment vehicle, if implementation occurs, then the subject's payment is determined solely by the exogenous cost of the good, so that $h(c,r) = c$. The plurality for implementation at actual cost c is $\frac{\mathrm{N}[1 - \mathrm{F}(c)] + \mathbf{1}(r \geq c)}{\mathrm{N}+1}$, where N is the number of survey respondents other than the subject, $\mathrm{F}(\cdot)$ is a CDF expressing the subject's beliefs about the responses of others in the survey, and $\mathbf{1}(\cdot)$ is an indicator that is one when its argument is true, zero otherwise. If risk aversion is not a factor and the subject believes that the probability of implementation is a positive fraction λ times the survey plurality for the good, then the subject will choose a response that maximizes the expected value of the difference between true WTP ω and prospective payment $h(c,r)$, multiplied by the probability of implementation, or

$$\text{Payoff} = \mathbf{E}_c(\omega - h(c,r))\cdot\lambda\frac{\mathrm{N}[1 - \mathrm{F}(c)] + \mathbf{1}(r \geq c)}{\mathrm{N}+1} = K + \frac{\lambda}{\mathrm{N}+1}\int_0^r(\omega - h(c,r))G'(c)\mathrm{d}c,$$

where K is a constant independent of r, and G is the CDF of subject's beliefs about c, conditioned on the framing of the survey (which in a referendum format includes the bid). First consider a *decoupled* payment vehicle, $h(c,r) = c$. Then this payoff is maximized at $r = \omega$ as long as G' is positive in a neighborhood of ω. Therefore, these beliefs lead to a truthful response. But these beliefs are consistent with *either* a referendum or an open ended elicitation format, provided both use a decoupled payment vehicle, and both prompt the beliefs that the probability of implementation is proportional to survey plurality and that actual cost may be above or below their true WTP. This is a trivial Nash equilibrium in which the optimal action for the subject is independent of the actions of others. I conclude that *both* referendum and open-ended formats *can* be truth-revealing mechanisms, *provided* they are framed to successfully induce the beliefs above. This result is partly at variance with Hoehn & Randall (1987) and Hanemann (1994), who compare a referendum format with a decoupled payment vehicle and an open-ended format with a non-decoupled payment vehicle, and conclude misleadingly that an open-ended format cannot be truth-revealing.

Of course, it is possible that a subject will hold beliefs that lead to misrepresentation of WTP, notwithstanding the prompting of the experimenter. If all the conditions in the last argument hold except that ω lies below all plausible cost levels c, then the consumer will choose $r = 0$ even if $\omega > 0$. Alternately, ω lying above the support of c leads to extreme overstatement of ω, in either an open-ended or a referendum format. If a subject believes that the probability of implementation for a given cost level c is increasing in his response level r for $r > c$, and that the payment vehicle is *decoupled*, then he has an incentive to *overstate* WTP. An open-ended elicitation that framed the link to implementation by stating that the probability of implementation is proportional to the benefit/cost ratio, with benefits estimated by the mean stated WTP of respondents, but that actual project cost would be spread evenly across consumers, would promote such beliefs. It is less natural, but not impossible, to induce a similar incentive-incompatibility in a referendum survey by indicating that "Yes" responses to high bid levels count more than proportionately in determining the probability of implementation.

Finally, consider the situation where the subject believes that the payment vehicle is coupled to response, so that $\partial h/\partial r > 0$. This creates an incentive to "free ride" by *understating* WTP. While an open-ended elicitation may be framed in a way that induces this belief, it need not be; e.g., the decoupled payment vehicle in an open-ended elicitation has $\partial h/\partial r = 0$.

A final question is whether subjects placed in a CV experiment with economic incentives will adopt rational strategies. Some experimental studies that are widely cited in the CV literature suggest that misrepresentation is quantitatively unimportant even when there *are* incentives to free ride (Bohm, 1972; Smith, 1979), suggesting that subjects are influenced by "precommittments" or "norms" in a "supergame" that encompasses far more than the immediate public good issue; see also Andreoni (1988), Asch et al (1993); Milon (1988); Palfrey and Prisbrey (1993); Prince et al (1992); Swallow (1994); Weimann (1994).

The anchoring experiments and discussions of incentives for misrepresentation suggest that at least some of the variability we see in CVM studies is indeed a "software problem", a reflection of the inability of the measurement technique to get past the consumer's superficial response rules. This is bad news for experts who want to use CVM in litigation right now; but on the whole, I think economists should be delighted if our only problem is that we need to refine the tool. There are a variety of techniques that could be borrowed from market research that have a hope of reducing the flak that consumers generate; I will mention two. Conjoint analysis uses batteries of questions that map out an extensive response surface; see Green and Srinivasan (1991), McFadden (1986). The method is not free of endowment and embedding effects, but it provides additional degrees of freedom that can be used to identify and perhaps moderate these effects. Information acceleration, a multimedia interactive technique that makes hypothetical markets much more realistic, can help by making environmental valuation seem more like shopping for a car, where observation and learning are critical; see Hauser et al (1993), Urban et al (1993, 1994, 1996). The argument is that if the process of forming an environmental value seems more like a familiar market choice process, then the consumer is more likely to invoke the analogies that induce the sort of "rational" valuation we see in ordinary markets; see Bergstrom et al (1990). More generally, there may be *ex ante* budget allocation or scaling exercises that can guide lawmakers to acceptable statutory penalties for environmental injury, even if reliable measurement of values *ex post* proves elusive.

The final question is whether consumers do have well-defined, stable, rational preferences, including preferences along dimensions that include existence of natural resources. If so, we may eventually get to a PSM that can measure them reliably enough so that they can be incorporated into environmental damage awards. If not, we will find as we probe deeper into the consumer that our instruments continue to interfere with the response, so there is no "there" there. This is an issue that far transcends the question of how to measure existence values, and goes to the question of whether the rational consumer model and the cost-benefit apparatus economists have built up over the past two centuries is a sound approach to issues of public policy.

While I think it is too early to write off classical economics, there is a mounting body of evidence, primarily from motivational and social psychology, but now also from some economists' research, that concrete needs and values are formed differently than abstract values. While concrete values usually conform well to the rational consumer model, abstract values more often appear to be the result of applications of *principles*, with the *process* of reaching a decision mattering as much as the result. The psychologist George Anslie (1982) writes "Since ancient times people have tried to understand the nature of value, this is, how events motivate us. Two kinds of good have been described: what might be called visceral satisfactions, closely associated with the consumption of a concrete object and usually in the service of an obvious biological need; and more subtle satisfactions, such as knowledge... . Quantitative description of the value of concrete objects became the science of economics. By restricting its attention to goods that trade in a cash market, this discipline has been able to describe striking regularities in how we value these goods. ... For all the usefulness that this ... may have had, it has tended to create a self-contained body of procedures without reference to the human motivational processes that actually determine value." Anslie goes on to describe a lengthy series of experiments and natural observations which he believes can be explained only if individuals have "multiple personalities", a modern variant of the medieval notion that man is dually enlightened and brutish. He describes the learning process in which children acquire self-control, learning to delay gratification, until in normal adults some degree of abstinence and control becomes an end in itself. Processes of precommittment, particularly adoption of rules or principles, become an important part of behavior. Conduct in an abstract choice situation is likely to be determined by deciding which principles apply. There is no reason for choices in different situations to be mutually consistent.

Money is a prime example of an abstract good, in which individuals develop what appear to be elaborate rules for how it is accounted for, how it can be used acceptably and unacceptably, and the process as well as the outcome of exchanges of money. "Neither a borrower nor a lender be" is a principle for conduct, not an instruction for rational behavior.

The psychologist Drazen Prelec (1990) distinguishes two modes of choice behavior by the cognitive processes involved: "Decision analysis, which codifies the rational model, views choice as a fundamentally technical problem of choosing the course of action that maximizes a unidimensional criterion, utility. The primary mental activity is the reduction of multiple attributes or dimensions to a single one, through specification of value trade-offs. For rule governed action, the fundamental decision problem is the quasi-legal one of constructing a satisfying interpretation of the choice situation. The primary mental activity involved in this process is the exploration of analogies and distinctions between the current situation and other canonical choice situations in which a single rule or principle unambiguously applies. ... By a rule or principle, I refer to any behavioral policy that overrides cost-benefit calculations. The purpose of rules must be derived from some weakness of our natural cost-benefit accounting system, and one might expect to find rules proliferating in exactly those choice domains where a natural utilitarianism does not produce satisfactory results."

Prelec goes on to identify situations where cost-benefit calculations get into difficulty as ones where there is a mismatch between cost and benefits in terms of time, saliency, or scale. He cites the adoption of principles such as "I always use a seat belt" or "I never smoke" to preempt a utilitarian calculation of the expected cost of one missed occasion to fasten your seat belt, or one missed occasion for a cigarette. An experiment you can try at home is to ask a friend for what payment they would give up their right to vote in the next election (WTA), and alternately the maximum poll tax they would pay to vote (WTP). For most people, WTA is much larger than WTP. A utilitarian explanation of this endowment effect requires that the indifference curve be kinked at the endowment. This rationalization becomes implausible when one observes that different individuals, or even the same individual given different endowments display kinks at the assigned endowments. For the voting example, a more plausible explanation is that individuals are guided by two principles, "voting is a right that you should not have to pay for", and "it is immoral to sell your vote".

There are two important observations about these views of decision-making. First, they do not deny the possibility of an underlying utilitarianism, although they question its relevance. Second, it may be possible to rationalize a system of rules as a consequence of an overarching utilitarianism, in which the "sensible self" establishes precommittments that prevent the "indulgent self" from excesses that would have undesirable consequences latter, or that lower decision cost. For example, a fully rational individual will when entering a car compare the cost of the five seconds of time required to fasten his seat belt with the probability of avoiding various injuries, given the distance to be traveled and driving conditions. A "sensible self" might decide that this calculus is too difficult, or too prone to misjudgment. Analogies may be made to the consequences for acquaintances who have or have not fastened their seat belts in the past, and a policy such as "always fasten your seat belt" or "I don't believe in seat belts" may result. Then, even though there may be a full utilitarian explanation for seat belt behavior, it may be one in which long term expectations and rule setting are paramount. Consequently, if you look at what the individual does on a single trip, and try to infer from this incident the individual's WTP to avoid injury, you might be seriously mislead. There is no reason for strategically optimal behavior to be tactically optimal when the purpose of strategy is to avoid tactics that have dangerous *long-run* implications.

In this psychological view of behavior, a question on the existence of a natural resource may invoke a rule-driven response rather than a utilitarian one. Examples might be rules that say "be agreeable when it does not conflict with self-interest", or "no matter how desirable the cause, it is not my responsibility". When individuals are unclear about the natural resource, or unsure about the benefits of the proposed action, rule-driven responses may be particularly likely. Further, CVM questions may be posed in ways that make them vulnerable to rule-driven responses. Asking for a trade-off between the environment and money may invoke principles regarding the desirability of protecting the environment, and principles regarding the treatment of money and its appropriate use. CVM may be affected by the particular rules that individuals use when they put values in dollars, and different patterns might emerge if trade-offs were requested in goods that are more alike in terms of scale and saliency.

Some psychologists and economists have concluded that existence value issues are examples of abstract choice behavior, that principle-driven inconsistencies are the source of the various embedding and framing anomalies, and that there are no stable rational preference for existence; see Diamond and Hausman (1993). It may indeed be necessary to go with or go through the individual's principles and protocols to discover taste fundamentals that are stable enough to feed into public policy decisions. My own hope is that this thicket has an end, and that beneath the layers of response that reflect manipulation of the individual by others and by himself, there are sufficient invariances so that a sensible method for accounting for the role of existence of resources in calculations of social welfare can be found. I suspect this is too big a job for CVM, but believe that some elaboration of PSM in a "grand jury" setting where the consumer is educated in depth on the environmental issues, trained to think about non-market valuation in a market-like way, and tested on a variety of decisions, has a chance of providing enough consistent data to establish persuasive estimates of value.

To conclude, I have an agenda for reform of NRDA. First, economists should do what they can to change the incentives in the current legal system, as these interfere with the unbiased scientific analysis that the role of expert presumptively requires. Second, economists should recognize that NRDA tasks are technically hard. They should avoid hubris about the reliability of their analyses, and seek arenas in which the technical problems can be resolved rather than dumped into the legal system as debating points. Third, economists need to look more closely at human behavior, particularly response in hypothetical market settings, recognize that it is not necessarily as simple as the rational model requires, and vigorously pursue measurement methods that can look behind superficial rules of conduct and strategic committment to principles. I believe that pursuit of these goals is simply a matter of "commons cents".

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