Echols, Mabel E.

From: on behalf of FN-OMB-OIRA-Submission
Subject: FW: comments on proposed executive order

Attachments: Farber and Hanemann Comments Final.pdf

Farber and
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From: Dan Farber
Sent: Monday, March 16, 2009 4:25 PM
To: FN-OMB-OIRA-Submission
Cc: Michael Hanemann
Subject: comments on proposed executive order

Please find attached comments on the proposed order dealing with regulatory impact analysis by myself and Professor Michael Hanemann.

Thank you.

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Rethinking the Role of Cost-Benefit Analysis

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For almost thirty years, regulatory agencies like EPA have been required to perform cost-benefit analyses (CBA) that are subject to review by the Office of Management and Budget. We welcome the willingness of the Administration to revisit this issue and the decision to allow public comments on this matter.

In this comment, we make six major recommendations:

1. *The Executive Order should eliminate the use of CBA to inhibit agency decision making where statutes mandate the use of a different regulatory standard.* It may be unfortunate that Congress has provided standards which give insufficient attention to the balance between costs and benefits. However, compliance with statutes takes precedence.

2. *The Executive Order should acknowledge the limitations of cost-benefit analysis in the context of climate change.* Given the current state of the art, cost-benefit analysis of climate issues is perilously open-ended. Analysis should stress potential downside risks as much as point estimates.

3. *The Executive Order should eliminate the requirement for the use of 7% real discount rate, and should also allow for use of a distinctly lower discount rate when long-term consequences (e.g., beyond fifty years) are being evaluated.* Given the strong evidence for hyperbolic discounting, a real discount rate such as 1% would be appropriate for assessing long-term impacts in CBA.

4. *The Executive Order should explicitly endorse the use of stated preference surveys to measure non-use value in CBA.* Non-use value can be an important component among the benefits of regulatory actions and it is essential that the economic methods required to measure non-use value be permitted for CBA.

5. *The Executive Order should require CBA to be transparent with respect to the distributional implication of regulatory actions.* Regardless of whether or not differential weights are employed, it is important to

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disaggregate costs and benefits by relevant groups in order to provide a transparent accounting of the consequences of regulatory actions.

6. *The Executive order should encourage agencies to use more explicit and sophisticated analytical methods in situations of high uncertainty.* Methods such as robust decision making (RDM) can provide more rigorous treatment of parameter or model uncertainty.

I. Statutory Preclusion of Reliance on Cost-Benefit Analysis

President Reagan's executive order recognized that some statutes do not allow regulatory decisions to be based on CBA. Because this is phrased as an exception to the general rule of CBA-based decision-making, the executive order and its successors give the impression that the exception is a rarity. The contrary is true. The general rule is that statutes provide other regulatory standards and do *not* allow EPA to base regulations on CBA.

Perhaps it would be a better world if Congress had provided broad discretion to regulatory agencies to use CBA, but the reality is quite different. Because most regulatory statutes provide some test other than cost-benefit analysis, imposing this extra-statutory requirement on regulators has dubious legitimacy.

A trio of Supreme Court cases drives home the lesson that Congress has given agencies specific tasks rather than allowing them to engage in an open-ended balancing of costs and benefits. *American Textile Manufacturers v. Donovan*[3] involved section 6(b) of OSHA, which governs occupational health standards for toxic chemicals. This section directs the agency to "set the standard which most adequately assures, to the extent feasible . . . that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life." The textile industry argued that this provision required the agency to show that the benefits of the regulation had a reasonable relationship to costs. The Court rejected this argument based on the plain meaning of the word "feasible." Indeed, the Court made it clear that CBA was impermissible as a regulatory standard under this statute:

> Congress itself defined the basic relationship between costs and benefits, by placing the "benefit" of worker health above all other considerations save those making attainment of this "benefit" unachievable. Any standard based on a balancing of costs and benefits by the Secretary that strikes a different balance than that struck by Congress would be inconsistent with the command set forth in § 6(b)(5). Thus, cost-benefit

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[3] 452 U.S. 490 (1981).

analysis by OSHA is not required by the statute because feasibility analysis is.[4]

We can see just how clearly the statute excludes CBA by contrasting the statutory text with the language that could have been used to require CBA. Recall that the statutes requires standards that assure "to the extent feasible . . . that o employee will suffer material impairment of health or functional capacity." Contrast that with a mandate to set standards to assure "that the level of risk to employees is economically optimal" or to assure "that the marginal cost of risk reduction does not exceed the monetary value of health or mortality to employees discounted to present value."

Similarly, in *Whitman v. American Trucking Associations, Inc.,*[5] the Court also found that the statute precluded CBA. Industry argued that EPA must use CBA in setting ambient air quality standards under the Clean Air Act. The provision in question, section 109(b)(1), directs EPA to set standards "the attainment and maintenance of which . . . are adequate to protect the public health" with an "adequate margin of safety." In an opinion by Justice Scalia, the Court held that this provision precludes the use of CBA. Justice Scalia remarked that, "[w]ere it not for the hundreds of pages of briefing respondents have submitted on the issue, one would have thought it fairly clear that this text does not permit the EPA to consider costs in setting the standards."[6] Moreover, he noted that the statute frequently does call for the consideration of costs in other contexts, and that for this reason the Court had "refused to find implicit in ambiguous sections of the CAA an authorization to consider costs that has elsewhere, and so often, been expressly granted."[7] Hence, industry had the burden of showing a "textual commitment of authority to EPA to consider costs" in setting air quality standards.[8] Justice Scalia rejected the argument that the statute's "terms 'adequate margin' and 'requisite' leave room to pad health effects with cost concerns."[9] He found it "implausible that Congress would give to the EPA through these modest words the power to determine whether implementation costs should moderate national air quality standards."[10]

The Court emphasized the duty of agencies to exclude policy considerations unrelated to statutory mandates in *Massachusetts v. EPA.*[11] In *Massachusetts v. EPA,*

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[4] Id. at 509.

[5] 531 U.S. 457 (2001).

[6] Id. at 469.

[7] Id. at 466.

[8] Id. at 468.

[9] Id. at 467.

[10] Id.

[11] 127 S. Ct. 1438 (2007).

states, local governments, and environmental organizations petitioned for review of EPA's denial of their petition asking EPA to begin a rulemaking to regulate greenhouse gas emissions from motor vehicles under the Clean Air Act.[12] EPA had argued that CO_2 is not a "pollutant" within the meaning of the Clean Air Act. It supported this argument with a grab bag of arguments intended to show that the CAA is poorly adapted to deal with climate change. EPA said that even if the statute actually did allow it to regulate greenhouse gases, it would exercise its discretion to avoid regulating because of these factors. In particular, EPA relied on the foreign policy dimensions of the climate change issue as a justification for not invoking domestic regulatory authority.

The Court found EPA's interpretation of the CAA incompatible with the plain language of the statute:

> The statutory text forecloses EPA's reading. The Clean Air Act's sweeping definition of "air pollutant" includes "any air pollution agent or combination of such agents, including any physical, chemical . . . substance or matter which is emitted into or otherwise enters the ambient air . . . ." §7602(g). On its face, the definition embraces all airborne compounds of whatever stripe, and underscores that intent through the repeated use of the word "any." Carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons are without a doubt "physical [and] chemical . . . substance[s] which [are] emitted into . . . the ambient air." The statute is unambiguous.[13]

Thus, as the Court interpreted the statute, greenhouse gases qualify as air pollutants and must be regulated by EPA if it finds that their climate impacts endanger human health or welfare.

The Court made it clear that EPA can consider only the existence of endangerment, not other policy factors. The Court reprimanded the agency for considering extraneous factors in exercising its discretion to deny the rulemaking petition:

> Although we have neither the expertise nor the authority to evaluate these policy judgments, it is evident they have nothing to do with whether greenhouse gas emissions contribute to climate change. Still less do they amount to a reasoned justification for declining to form a scientific judgment. In particular, while the President has broad authority in foreign affairs, that authority does not extend to the refusal to execute domestic laws.[14]

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[12] 127 S. Ct. at 1449-1451.

[13] Id. at 1459.

[14] Id. at 1463. As the Court said,

> Under the clear terms of the Clean Air Act, EPA can avoid taking further action only if it determines that greenhouse gases do not contribute to climate change or if it provides some

American Trucking involved a provision that precluded any consideration of costs in setting a regulatory standard. There are many other provisions of environmental law that do provide for consideration of costs, but Congress does not generally instruct EPA to engage in open-ended balancing of costs and benefits, or to consider other factors that EPA may consider relevant. Instead, Congress usually gives more specific directions, generally by specifying the level of pollution control technology required in a given context. For instance, in various different settings, the Clean Air Act calls for the use of:

- Reasonably Available Control Technology for existing sources in nonattainment areas, based on average industry;

- Best Demonstrated Available Technology for categories of new sources, based on cost and other factors;

- Best Available Control Technology for new sources in areas that exceed required air quality standards, based on the maximize feasible pollution reductions;

- Maximum Achievable Control Technology for major sources of hazardous air pollutants, requiring existing sources to match the best twelve percent of the industry and new sources to match the best controlled existing source;[15] and

- Lowest Achievable Emissions Reduction for new or modified stationary sources in nonattainment areas, requiring the most stringent existing emissions limits achieved in practice by the industry or included in any state implementation plan even if not achieved in practice.[16]

The application of these standards is not always clear, and it is even conceivable that some of them allow for the use of CBA. But even if the statutory language were open to this interpretation, it would clearly be unreasonable to view

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reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do. To the extent that this constrains agency discretion to pursue other priorities of the Administrator or the President, this is the congressional design.

Id. at 2462.

[15] EPA views this provision as excluding consideration of risk levels, with apparent support from the courts. See Patricia Ross McCubbin, *The Risk of Technology-Based Standards*, 16 Duke Env. L.J. 1, 42-44 (2005) (although the author suggests that EPA covertly does consider risk, id. at 42, first paragraph).

[16] This summary is derived from Daniel A. Farber, Jody Freeman, Ann E. Carlson, and Roger W. Findley, Cases and Materials on Environmental Law 539 (7th ed. 2006). For a listing of the similar set of standards under the Clean Water Act, see id. at 673-674.

all of these statutory standards as allowing CBA since that would collapse into one the multifarious standards that Congress so carefully distinguished.[17]

The upshot of all this is that relatively many environmental statutes do not allow the kind of open-ended balancing that CBA provides. Congress has carefully specified the factors to be considered in setting environmental standards, usually in terms of public health or delineated levels of technological feasibility. Cost-benefit analysis should not influence regulatory decisions under these statutes.

Importing legally irrelevant factors into a decision violates the basic precepts of modern administrative law. In *Citizens to Preserve Overton Park, Inc. v. Volpe*,[18] the Court held that agencies must provide a reasoned explanation of their decisions based on the relevant statutory factors. Being within the range of reasonable outcomes is not enough; instead, the reviewing court "must consider whether the decision was based on a consideration of the relevant factors and whether there has been a clear error of judgment."[19] Thus, when the agency acts, it must do so on the basis of a judgment about the legally relevant factors, not based on extralegal considerations.

Nor does Congress typically give EPA broad discretion to refuse to regulate. Environmental statutes such as the Clean Air Act are replete with regulatory deadlines intended to force EPA's hand. As *Massachusetts v. EPA* makes clear, EPA cannot shirk these congressional mandates based on extralegal factors.

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[17] It is hard for me to see how anyone could quarrel with OMB Watch's recommendation that:

> If a statute directs agencies to promulgate regulations according to standards of best available technology or with an adequate margin of public health protections, for example, the regulatory options should follow that statutory mandate. This fundamental principle must be followed if the president decides he wishes OIRA to continue transactional reviews of individual significant regulations.

OMB Watch, Advancing the Public Interest Through Regulatory Reform: Recommendations for President-Elect Obama and the 111th Congress 24 (2008), available at http://www.ombwatch.org/ If this principle is respected, however, the ability of CBA to guide EPA regulations is quite limited under current legislation.

[18] 401 U.S. 402 (1971).

[19] Id. at 414. In theory, at least, administrators may be required to testify in order to determine whether the formal findings reflect their actual reasoning:

> The court may require the administrative officials who participated in the decision to give testimony explaining their action. Of course, such inquiry into the mental processes of administrative decision makers is usually to be avoided. United States v. Morgan, 313 U.S. 409, 422, 61 S.Ct. 999, 1004-1005, 85 L.Ed. 1429 (1941). And where there are administrative findings that were made at the same time as the decision, as was the case in *Morgan*, there must be a strong showing of bad faith or improper behavior before such inquiry may be made.

Id. at 420.

Courts are understandably reluctant to look beyond an agency's formal explanation of its action in order to determine whether OMB pressure based on extralegal considerations shaped the decision. But the hesitance of court to intervene does not excuse efforts to exert such pressure. Article II of the Constitution makes it the duty of the president to "take care that the laws be faithfully executed," not the duty to "take care that executive branch actions survive judicial review." Faithfully executing the laws means applying the legal standards prescribed by Congress, even in the absence of judicial enforcement, not the legal standards that the president wishes Congress had prescribed.

In short, for most provisions of the environmental statutes that govern EPA, it is unlawful to shape regulations based on CBA or to block regulations that fail to satisfy CBA. Advocates of CBA may or may not be right that CBA is the best way to set environmental standards. That is an argument that they should make to Congress. Under existing law, it is not an argument that the executive branch can lawfully give effect to under most environmental statutes.

When statutes preclude the use of cost-benefit analysis as a decisional factor, OMB's role should be limited to ensuring that the agency has applied the statutory standard provided by Congress in a reasonable and responsible way.

II. Admit the Current Limitations of Cost-Benefit Analysis in the Context of Climate Change

Climate change is the most serious environmental issue facing the world today. Although we can endlessly debate whether CBA would be a valid method of setting climate policy, this is, at least for the present, beside the point. CBA simply is not capable of generating clear conclusions regarding climate change. Instead, we must take into account other sources of guidance in order to make sensible decisions.

Many individual elements of the economic impact analysis are the subjects of serious debate. For instance, economists hotly dispute the net effect of climate change on agriculture, with some finding an overall positive effect on U.S. agriculture (but with very large regional variations),[20] while others find substantial negative effects.[21] If we do not even know the signs of important elements of the economic impact, our ability to predict overall impact (taking into account all of the feedback loops of the economy) is obviously going to be difficult.

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[20] *See* Oliveir Deschenes & Michael Greenstone, *The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather*, 96 Amer. Econ. Rev. 354 (2007) (but note that this study excludes possible impacts of increases in extreme events such as storms and droughts).

[21] Wolfram Schlenker, W. Michael Hanemann & Anthony C. Fisher, *The Impact of Global Warming on U.S. Agriculture: An Econometric Analysis of Optimal Growing Conditions*, 88 Rev. Econ. and Statistics 113 (2006).

There are now about a dozen models that connect climate change predictions to economic analysis.[22] These models differ in a number of dimensions: their focus on the energy sector or reliance on a broad macroeconomic analysis; the degree to which they analyze localized versus average global impacts; and their treatment of uncertainty.[23] Model results differ correspondingly.

For example, the Mendelsohn model estimates impacts for five market sectors and finds positive economic effects for temperature increases up to about 4 °C, whereas the Toll model finds small net economic losses at all levels in terms of global output but estimates the losses to be twice as high when measured in terms of individual welfare rather than dollars (because many of the costs fall on poorer populations).[24]

The Nordhaus model includes a broader range of impacts (market and non-market) and also made the first effort to take into account the economic costs of potential catastrophic impacts.[25] The Nordhaus model assumes nonlinear effects of climate change, so that a 6 °C change produces about twice as much harm as a 4 °C change.[26] Despite these attractive features, the Nordhaus model also has significant limitations where modeling had to be based on assumptions rather than data or theory. For example, the shift away from carbon intensive energy sources is assumed to follow historical trends, rather than reflecting incentives for new technologies.[27]

In contrast to Nordhaus, the Stern Report finds considerably higher levels of harm.[28] In terms of policy, Stern reaches much different conclusions than Nordhaus. Stern argues that, "if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever."[29] Indeed, if "a wider range of risks and impacts is taken into account, the estimates of

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[22] For a list, *see* Kendal McGuffie and Ann Henderson-Sellers, A Climate Modeling Primer 242.(3d ed. 2005),

[23] *Id.* at 240-243 (treatment of uncertainty is tabulated on p. 242).

[24] Nicholas Stern, The Economics of Climate Change 166-167 (2007).

[25] *Id.* at 167.

[26] *Id.* at 167.

[27] Id. at 51. Compare Richard S. J. Tol, Carbon Dioxide Emissions for the USA, www.ssrn.com/abstract=932508 (noting that the "model cannot anticipate structural breaks. This is a humbling conclusion for a 100 year forecast." And "history-based projections are not robust to radically new technologies.") Another example of the roughness of the modeling is that the calculations of the impact of sea level rise exclude storms, impacts on undeveloped lands, and storm damage, which the authors attempt to compensate for with what they consider a conservative estimate. Similarly, the cost of catastrophic harm was roughly estimated via a survey of experts followed by some "assumptions" about the degree of harm.

[28] Stern, supra note , at 186.

[29] Id. at xv.

damage could rise to 20% of GDP or more."[30] Not surprisingly, Stern recommends stringent control of emissions.

It is commonly thought that the divergence in the estimates of the damages from climate change between the Stern Report and the other economic models is due simply to the difference in the treatments of discounting, but this is incorrect. Stern differs from previous studies in that his estimate of the *undiscounted* damages from climate change is significantly more pessimistic than theirs. There are several reasons for the difference. First, Stern uses an assessment model which tracks the impacts of climate change through 2200, whereas the other models run through 2100 or 2150. Temperatures continue to rise beyond 2100 under many emissions scenarios, which raises the total damage when the analysis extends to 2200. Second, the economic damage and cost functions used in the other models are based largely on literature prior to 2000, while the Stern Review has better coverage of the more recent work by scientists on the physical impacts of climate change; the more recent studies use different methodologies, provide more detail, and generally reach more pessimistic conclusions. Third, the Stern Review tends to be more global in its coverage of damages. Most of the existing damage functions were calibrated using studies of the USA which were then scaled for application to other regions of the world. The Stern Review made a greater effort to collect information about other regions, especially Africa and Asia, where the impacts are likely to be more adverse.

Two points about the damage estimates should be emphasized. First, the paucity of the available data for many of the factors that determine the impacts of a given climate change scenario can scarcely be overstated. Because of the spotty nature of the data available, analysts inevitably have had to extrapolate the results from an analysis of one location to other locations that could well be quite different. The resulting damage functions, therefore, depend very heavily on subjective judgments by the researcher. These subjective judgments accounts in part for the differences in conclusions regarding the economic impact of climate change. Second, aggregation over space and time when characterizing impacts matters greatly and significantly affects the assessment of impacts: because of convexity in the damage functions, the more disaggregated the estimate the larger the aggregate net damage.

This can be illustrated using the temperature implications of the B1 emission scenario as simulated by the HadCM3 climate model. Under this scenario there is a 2° increase in *global* average temperature by 2100, compared to the average in 1990-1999. This global average is the figure used in most of the earlier estimates by economists of the damages from climate change. However, it is a highly misleading figure. The temperature increase is distributed unevenly around the globe; the increase is smaller over the ocean and in lower latitudes, and larger on land and at higher latitudes. By 2100 in California and much of the US west under this scenario, there is a 3.3° C increase in *statewide* average annual temperature. The increase is

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[30] Id.

different at different times of the year. Statewide average *winter* temperature (December – February) in California rises by 2.3° C, while statewide average *summer* temperature (June – August) rises by 4.6 ° C. Moreover, there is spatial variation between the temperature increases along the coast versus inland. In the Central Valley, the main farming area in California, the increase in summer temperature reaches 5° C. Given the convexity of damage functions, it makes a substantial difference to the estimated impact on California agriculture (or, for example, to the estimate of summertime mortality from extreme heat) whether one represents the climate change as an increase of 2° C (global average annual temperature), 3.3° C (statewide average annual temperature), or 5 ° C (Central Valley average summer temperature). While the effect on yield of 2° C temperature increase combined with carbon fertilization may or may not be positive, the effect of a 5° C increase during the growing season is likely to be negative. Even these figures understate the adverse effects, because they are *seasonal* average temperatures while most of the damage from climate change is associated with extreme events that occur on the time scale of days and sometimes even hours.

The science of climate impact estimation is still in its infancy; spatial and temporal disaggregation are key dimensions in which future progress can be expected; because of nonlinearity in damage functions, the disaggregation may well raise future estimates of aggregate net damages. Hence, extreme caution is required before using current CBA analyses as guidance for federal policy.[31]

Models also differ in their assessments of the costs of complying with the Kyoto Protocol, with the range running from negligible losses to at least one to two percent of GDP, annually.[32] The models differ in terms of three critical assumptions about the timing of abatement efforts, the types of policy instruments used, and the likelihood of technological innovation.[33] Other relevant factors include the willingness of economic actors to substitute away from high carbon technologies and trends in energy efficiency.[34]

There are similar difficulties in modeling the costs of mitigating and adapting to climate change. Most of the model results are in the range of two to five percent of GDP in 2050. However, the range spans from a four percent *gain* in GDP due to

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[31] Last summer, NHTSA considered climate change impacts in the context of a cost benefit evaluation of proposed rule-making for NHTSA-2008-0089-0002 dealing with average fuel economy standards for passenger cars and light trucks for model years 2011-2015. Comments submitted by Hanemann on July 15, 2008 suggested that the damage estimate used by NHTSA was too low by a factor of about 3.5.

[32] Jason F. Shogren and Michael A. Toman, *How Much Climate Change is Too Much?, in* Climate Change Economics and Policy: An RFF Anthology 42 (Michael A. Toman ed. 2001).

[33] *Id.*

[34] *Id.* at 43.

reduced use of carbon to a fifteen percent *loss* of GDP.[35] A meta-analysis shows that key factors in explaining these differences include the following: whether revenue from carbon taxes is recycled; what kinds of technological changes are assumed; whether shifts in energy sources have non-climate benefits; and whether the model includes international carbon trading.[36] Hopefully, economists will be able to narrow the uncertainty, but it is discouraging that at this point they cannot even agree on whether the economic effect is positive or negative.

Remarkably, many economists' models assume that placing a higher price on carbon will not cause increased innovation toward clean technologies. If it is true that financial incentives do not affect the rate of innovation, the entire law of intellectual property is radically misguided. One can only wonder whether the same economists would be willing to support a proposal to abolish IP rights in energy technologies on the ground that technological innovation is exogenous.

Modeling the systemic economic impact of climate change as well as the costs of adaptation and mitigation involves tremendous challenges, particularly if the projection goes out more than a few years.[37] Economic models must build on the outputs of climate change models, which are themselves uncertain in terms of the high end of the risk spectrum. Then there is the difficulty of forecasting the trajectory of the economy over future decades. This clearly cannot be done in detail – for example, no forecaster in 1970 would have predicted the explosive growth of personal computers, let alone the Internet, neither of which existed at the time, nor that complex financial derivatives, which also did not exist in 1970, would threaten a major economic depression today.

Forecasting even at a crude level must rely heavily on the assumption that the future will on average be much like the recent past: for example, that technological progress will continue at something like its current pace and that some unforeseen catastrophe will not cause a long-lasting economic crash. Even predictions for specific economic sectors are difficult. Past experience with models that project energy use do not lend much confidence to these predictions. The projections have generally been too high, by as much as a factor of two.[38] Projecting adaptation measures, which is important in terms of determining the harms created by climate change, is made more difficult by the institutional barriers that may prevent optimal use of adaptation: for instance, the history of federal flood control

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[35] Stern Report, *supra* note 91, at 269.

[36] *Id.* at 271.

[37] A good overview of modeling issues can be found in J.C. Huracade, *et al.*, *Estimating the Costs of Mitigating Greenhouse* Gases, in Climate Change 1995: Economic and Social Dimensions of Climate Change: Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change (James P. Bruce, Hoesung Lee & Erik F. Haites eds. 1996). Of course, in the decade since this report, models have improved in their capacity to handle these issues.

[38] Stephen J. DeCanio, *Economic Models of Climate Change: A Critique* 138-143 (2003).

gives little ground for optimism that flood control projects will be optimally designed. To the extent that climate change scenarios are based on projections of future emissions, they implicitly make assumptions about future political and economic developments, which are imperfectly known (to say the least).

Outputs of various economic models are so far apart as to make it perilous to rely on any one model or even a small subset. According to a recent review, "cost estimates of Kyoto emissions reductions diverge by a factor of about 500 (and not all estimates show an economic loss.)"[39] As noted earlier, there is also evidence of a systematic bias in ex ante economic studies to overestimate the cost of complying with environmental regulations. In any event, estimates of mitigation costs must be taken with a large grain of salt. Cost-benefit analysis, for this reason, may be useful to explore scenarios and eliminate some extreme policy options, but it cannot reliably identify an optimum policy.

Two general problems with cost-benefit analysis have particular relevance for climate change. First, non-market benefits in the form of ecosystem preservation are difficult to assess, yet ecosystem damage is a critical factor in assessing climate change. Climate change will transform existing ecosystems and endanger biodiversity, and this harm needs to be part of the CBA calculation. Second, climate change requires the use of discounting because of the long time spans involved in climate policy, yet the legitimacy of discounting is contested, as is the choice of discount rate.

III. The Need for a More Realistic Discount Rate

OMB currently requires federal agencies to use discount rates of 3% and 7% in CBA studies. These are intended as real rather than nominal discount rates. By any accounting, 7% is a remarkably high figure for a real discount rate; it bears no relation to the federal government's cost of borrowing, nor to any plausible conception of a social rate of time preference. Unless a sound economic justification can be supplied for this rate, we believe its use should be discontinued.

The choice of a discount rate has a profound effect on policy recommendations regarding climate change and other long-term environmental issues.[40] There is nothing approaching a professional consensus, however, about the appropriate rate. As Daniel Cole explains:

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[39] Philippe Tulkens and Henry Tulkens, *The White House and the Kyoto Protocol: Double Standards on Uncertainties and Their Consequence* 8 (June 2006), available at http://ssrn.com/abstract=910811.

[40] As Cass Sunstein explains:

> If an agency chooses a discount rate of 2%, the outcome will be very different from what it would be if an agency were to choose a discount rate of 10%; the benefits calculation will shift dramatically as a result. If a human life is valued at $8 million, and if an agency chooses a 10% discount rate, a life saved 100 years from now is worth only $581. "At a discount rate of 5%, one death next year counts for more than a billion deaths in 500 years."

> Perhaps the most obvious lesson from the *Stern Report* and its critics (at least for those who have not already learned it) is that the choice of parameter values (including discount rates, coefficients of relative risk aversion, and per capita consumption growth rates) can decisively influence the outcome [of CBA]. Unfortunately the *Stern Review* and its critics also remind us of just how far away we remain from being able to specify a consensus "best practice" for selecting parameter values.[41]

The extent of disagreement about discounting can be seen in a recent symposium on the subject in the *University of Chicago Law Review*, where recommendations ranged from rejection of discounting entirely;[42] to use of the riskless rate of return, perhaps coupled with hyperbolic discounting;[43] to use of an infinite discount rate by administrative agencies for effects beyond thirty to fifty years.[44]

We ourselves believe there is a very strong economic case for some form of hyperbolic discounting that would apply a much lower discount rate (say 1% if not less) for effects beyond some horizon such as fifty years than for effects before them. Hyperbolic discounting is equivalent to exponential discounting but applied to *relative* rather than absolute changes in time. There is strong empirical evidence that people discount the future in such relative terms when acting both as individuals and in groups. The theoretical argument against hyperbolic discounting is that it leads to time inconsistency in decision making – it can lead to the adoption of a policy now based on the expectation that certain future actions will be taken when, in fact, future decision makers will not choose to undertake those actions. However, the practical force of this argument is highly questionable. We have a political system where governments change every eight years, if not more frequently, and where current administrations have limited power to bind the actions of their successors. Time inconsistency is an essential feature of the American political system. It should therefore not be seen as a persuasive argument against the use of hyperbolic discounting by the federal government.

IV. Non-use Value and Stated Preference

Cass R. Sunstein, Cost-*Benefit Default Principles*, 99 Mich. L. Rev. 1651, 1711 (2001).

[41] Daniel H. Cole, The *Stern Review* and Its Critics, Implications for the Theory and Practice of Benefit-Cost Analysis, 48 Nat. Res. J. 53, 81 (2008).

[42] See Douglas A. Kysar, *Discounting . . . on Stilts*, 74 U. Chi. L. Rev. 119 (2007) (the title being a reference to Bentham's phrase "nonsense on stilts" as a description for natural rights).

[43] W. Kip Viscusi, *Rational Discounting for Regulatory Analysis*, 74 U. Chi. L. Rev. 209, 221, 240 (2007).

[44] See Eric A. Posner, *Agencies Should Ignore Distant-Future Generations*, 74 U. Chi. L. Rev. 139 (2007). The title is misleading since the recommendation would affect not only near generations but younger members of the current generation. Note that this proposal would not only discourage investments in environmental protection but also in public health measures for young people and all forms of long-lived infrastructure. But perhaps the proposal was tongue-in-cheek.

Non-use value is the value placed on an item by people for motives unconnected with their own use or consumption of the item. As the NOAA Panel on Contingent Valuation stated:

> "But for at least the last twenty-five years, economists have recognized the possibility that individuals who make no active use of a particular beach, river, bay, or other such natural resource might, nevertheless, derive satisfaction from its mere existence, even if they never intend to make active use of it. This concept has come to be known as "existence value" and it is the major element of what are now referred to as "non-use" or "passive-use" values"[45]

By definition, non-use value cannot be measured through revealed preference; instead, some form of stated preference approach is required to measure nonuse value. As noted above, non-use values may be a significant component of the damages associated with climate change, and they often arise in the context of federal regulatory measures.[46] Moreover, with use values, forms of congestion sometimes arise which inherently limit the number of people who can have a use value for a given item. With non-use value, by contrast, there is not a possibility of congestion: non-use value is a pure public good which can generate benefits for a potentially large number of individuals simultaneously. Hence, non-use values can sometimes be large relative to use values. This is all the more reason why it is essential to permit non-use values to be admitted into CBA.

At times in the past, OMB has interacted with some federal agencies in a manner which suggested that OMB was going out of its way to hinder or impede the measurement of non-use values for inclusion in a federal CBA. OMB has sometimes appeared to harbor an institutional hostility to stated preference and has used its opposition to stated preference as a reason for disallowing valuation surveys by federal agencies. If so, we believe this is unfortunate and ill-advised.

The NOAA Panel proposed guidelines and specified conditions for the conduct of contingent valuation (CV) surveys. It went on to state: "The Panel concludes that under those conditions (and others specified above), CV studies convey useful information. We think it is fair to describe such information as reliable by the standards that seem to be implicit in similar contexts, like market analysis for new and innovative products and the assessment of other damages normally allowed in court proceedings" (p 43).[47] We can see no reason for OMB to

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[45] NOAA Panel on Contingent Valuation, January 11, 1993, page 3. The panel members were: Kenneth Arrow, Robert Solow, Edward Leamer, Paul Portney, Roy Radner and Howard Schuman

[46] For example, the NOAA Panel started from the premise "that passive-use loss --interim or permanent -- is a meaningful component of the total damage resulting from environmental accidents" (p 42).

[47] Another approach for valuation of non-market costs and benefits is the concept of ecosystem services. For discussion, *see Symposium*, 20 Stan. Env. L.J. 309 (2001); James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 NYU L. Rev. 870 (2005).

adopt a position towards CV or stated preference generally which is more restrictive than that recommended by the NOAA Panel.[48]

V. The Importance of Distributional Considerations

While there is an extensive literature on the shortcomings of the Kaldor-Hicks Potential Pareto Compensation (PPC) criterion for social welfare, and there is a well-developed economic theory on how to reflect distributional considerations in a social welfare function, CBA analysts tend to stick rigidly and unreflectively to the PPC criterion. We see no justification for the narrowness of that practice.

We believe that it is highly desirable to conduct CBA in such a way as to render transparent the impact of the proposed regulation on the welfare of the different groups of people affected by it. This can and should be done even if there is an unwillingness to apply different social weights to those different groups. What is called for is the *disaggregation* of the various costs and benefits by the relevant groups.[49] This is something which is usually both feasible and relatively costless for the analyst to perform: it just requires a *willingness* to disaggregate and be more transparent.

VI. The Need for More Explicit and Sophisticated Treatment of Uncertainty

OMB in the past has been too reliant on point estimates. At the very least, in important cases, sensitivity analysis should also be included. In many cases, because of the high degree of uncertainty regarding key parameters or system structure, the high end and low end estimates may be more important than the point estimate. In situations of high uncertainty, agencies should consider the use of new and more sophisticated analytic tools.

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[48] It should be noted, however, in the 16 years since the NOAA Panel issued its report, there have been some developments in the field of survey research which leave its findings somewhat out of date. A specific example is survey response rates. Professor Jon Krosnick of Stanford University has shown convincingly that even when well-conducted surveys have response rates below 20% there may be no significant difference in their results compared to those of well-conducted surveys with response rates of 60-70%. The response rate itself is not a reliable indicator of the quality of the survey.

[49] What the relevant groups are is something that depends on the context and requires judgment by the analyst. They may be social, demographic or economic groups; they may also be disaggregated spatially by region of the country.

RAND researchers have developed a particularly promising method to use computer assistance in scenario planning.[50] The key is a technique called Robust Decision Making (RDM):

> RDM uses computer models to estimate the performance of policies for individually quantified futures, where futures are distinguished by unique sets of plausible input parameter values. Exploiting recent advances in computing power, RDM evaluates policy models once for each combination of candidate policy and plausible future state of the world to create large ensembles of futures. These ensembles may include a few hundred to hundreds of thousands of cases.[51]

This technique provides a method for examining many potential scenarios in order to determine which characteristics of the scenarios are critical to the success or failure of particular strategies.[52]

RDM provides a systematic way of exploring large numbers of possible policies to identify robust solutions.[53] During each stage, RDM uses statistical analysis to identify policies that perform well over many possible situations. It then uses data-mining techniques to identify the future conditions under which such policies fail. New policies are then designed to cope with those weaknesses, and the process is repeated for the revised set of policies. As the process continues, policies become robust under an increasing range of circumstances, and the remaining vulnerabilities are pinpointed for decision makers.[54]

These methods may be especially useful when society must make large, long-term investments in infrastructure such as dams, water supply systems, or major power plants. Investments that fare well under some future scenarios may do badly in others, and a major purpose is to choose investments that are resilient across the most relevant risks. Computerized scenario analysis can help us determine the key areas in which investments vary in their resilience, so that policymakers can make informed choices between them. Scenario analysis may also help determine what factual issues are critical for deciding between options.

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[50] David G. Groves, *New Methods for Identifying Robust Long-Term Water Resources Management Strategies for California* (2006), *available at* http://www.rand.org/pubs/rgs_dissertations/2006/RAND_RGSD196.pdf.

[51] *Id.* at 125. *See also* David G. Groves and Robert J. Lempert, *A New Analytic Method for Finding Policy-Relevant Scenarios*, 17 Global Change 73 (2007).

[52] For an effort to test the usability of this approach for water agencies, see David G. Groves et al., *Presenting Uncertainty to Water-Resource Managers: A Summary of Workshops with the Inland Empire Utilities Agency* (RAND Technical Report 2008).

[53] This is a more formalized version of the familiar technique of scenario analysis, as described in James A. Dewar, Assumption-Based Planning: A Tool for Reducing Avoidable Surprises (2002).

[54] *Id.*