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Mock Referenda for Intergenerational Decisionmaking

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Abstract

Traditional applications of benefit-cost analysis make use of what we refer to as the "damage function and discounting" (or DFD) approach. This approach is well-suited to the analysis of projects for which the principal benefits and costs occur within the next thirty to forty years, say. However, for projects with significant intergenerational consequences--i.e., impacts that do not arise for hundreds of years or more--the DFD approach becomes almost intractable. We propose an alternative conception of benefit-cost analysis for intergenerational decisionmaking--the mock referendum--that is: (i) arguably more consistent with the tenets of modern welfare economics; (ii) more amenable to the analysis of long-term projects or policies; and (iii) consistent with political decision(s) that must be made if climate mitigation (or other long-term environmental protection) measures are to be taken.

Key Words: discounting, non-market valuation, intergenerational equity, contingent valuation

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Table of Contents

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I. INTRODUCTION

Virtually the entire literature on the application of benefit-cost analysis (BCA) to environmental issues is premised on a particular conceptual approach. This approach--which, for reasons of convenience, we will refer to hereafter as the "damage function and discounting" (or DFD) approach--is comprised traditionally of two distinct steps. First, the favorable and unfavorable effects of a proposed policy intervention at all future points in time are identified and expressed in dollar terms.[1] Second, the time streams of future benefits and costs are converted to present values using a single discount rate (or a range of rates when a sensitivity analysis is included). It is difficult to find even one benefit-cost assessment performed inside or outside government for a proposed environmental regulatory program that has not adhered to the DFD approach. Moreover, while the recent report of Working Group III of the IPCC[2] does contain some discussion of alternative decisionmaking frameworks, the DFD approach is by far the dominant paradigm, even if its primacy is implicit. Finally, the chapter in that report, "Intertemporal Equity, Discounting, and Economic Efficiency," is clearly premised on this same approach.

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1 Subsumed here is the translation of the policy change into changes in environmental conditions (cleaner air, for instance), as well as the translation of the latter into improved human health, enhanced visibility, reduced material damage and other physical benefits.

2 *Economic and Social Dimensions of Climate Change* (Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change), (New York, Cambridge University Press, 1996).

For many environmental and other types of policy interventions, the damage-function-and-discounting approach is a perfectly appropriate means of analysis. In general, the DFD approach will be reasonable when the principal benefits and costs associated with a project will occur within, say, thirty or forty years. But for a handful of other, more "exotic" proposed projects, the benefits and costs of which will be spread out over many generations, the DFD approach becomes intractable for reasons spelled out below. Examples of such projects or programs include proposed solutions to the storage of low- and high-level nuclear wastes (which can remain highly radioactive for tens of thousands of years),[3] habitat protection for threatened and endangered species (which, if they were to become extinct, would be forever lost to all future generations), and, of course, policies to slow or reverse the accumulation of carbon dioxide and other greenhouse gases in the atmosphere (the principal benefits of which would not be felt for hundreds of years).[4]

This does *not* mean, however, that benefit-cost analysis has little to contribute to the analysis of such problems. In fact, our purpose here is to propose an alternative conception of BCA, which we refer to as a "mock referendum," for application in cases where proposed policy interventions have significant intergenerational effects. Among its several advantages is the fact that our proposed approach is based on individuals' *own* valuations of future benefits and costs, as well as their *own* views as to how future effects ought to be traded off against present ones. In that sense, the mock referendum approach would seem to fit more

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[3] Kneese (1973).

[4] This abstracts from the so-called ancillary benefits that may be associated with carbon mitigation strategies--e.g., reductions in ambient concentrations of particulate matter and photochemical oxidants--that could be felt immediately. These should be given increased attention in analyses of proposed climate policies.

comfortably within the traditional conception of a welfare economics anchored squarely in individual preferences.

In Section II, we discuss the difficulties that the DFD approach confronts when applied to problems like global climate change, difficulties related both to valuation and to discounting. Next, we present our proposed alternative, the mock referendum, and discuss its advantages and, importantly, the primary disadvantage it raises. There we point out that, in addition to its philosophical and analytical appeal, the mock referendum is also attractive for a very practical reason: it mimics the political determination that must be made--either directly by voters, or by their elected representatives--if climate mitigation measures are ever to be taken. We conclude with a statement of our interest in an ambitious and potentially important application of our proposed approach.

II. SHORTCOMINGS OF THE DFD APPROACH

Anyone familiar with benefit-cost analysis, and certainly anyone who has contemplated its application to an issue like global climate change, is aware of the problems posed by the DFD approach. First, and obviously, it requires one to estimate in dollar terms the benefits and costs that will occur in future years. This itself presents several problems. One could conceive of this task as filling in the cells of a matrix in which the columns represent types of benefits and costs. For instance, one column would represent, in dollar terms, the premature mortality that would be forestalled by climate mitigation measures, another column the real property protected by preventing sea-level rise and more frequent storms, still another the increased agricultural output a more moderate climate would permit, and so on. Other columns in the matrix, of course, would represent higher fuel prices, lost job opportunities, the inconvenience

associated with smaller cars, and any other costs (including some environmental harms) associated with climate mitigation measures. It should go without saying how difficult it can be even to assign dollar values to some benefits and costs that will occur in the immediate future.

The rows in this "effects matrix" would be the years in which the benefits and costs would occur. Thus, obviously, there would be as many rows as there would be years--quite a matrix to contemplate in the case of a nuclear waste disposal program, for instance. How, in this latter case, for instance, would we determine how many fewer cancer cases there might be one hundred years from now (not to mention one thousand or ten thousand years) if nuclear waste disposal methods are made more stringent, when we can have very little idea what life will be like at that time (just as our forbears in 1896 could scarcely imagine what life today would be like)? What value should we attach to these lives prolonged even if we could confidently enumerate them?

A final complication for this picture is that the values to be attached to each cell in this matrix--say, preventing three hundred deaths in Sri Lanka in the year 2120--will vary among those individuals alive today. Thus, we ought really to have a three dimensional matrix in effects (negative and positive), time, and individuals. The latter problem is generally surmounted by assigning "average" values to various types of effects, but we all know that this practice, while providing tractability, is not very satisfactory.

Even if we were comfortable with the values to be attached to different types of benefits and costs at different points in time, we would still have to face the selection of "the" discount rate to use in calculating present values. Chapter 4 of the Working Group III Report presents two different approaches to selecting the discount rate. The first approach, which the

authors of that chapter dub the "prescriptive approach," is, as they put it, ". . . constructed from ethical principles" (p. 131). The second, or "descriptive approach" involves identification of the rate of return to (or opportunity cost of) capital, appropriately adjusted for risk. According to Chapter 4, the former approach generally results in a discount rate in the range of 0.5-3.0 percent, while the latter produces a higher rate, generally in excess of 5 percent in real terms.

There are problems with either approach. First, the prescriptive approach is premised on the view that there is an ethically or morally "correct" rate of discount to use in project evaluation--a rate that is independent of the views of the present generation (save, of course, those who get to determine what the morally just rate is). Yet those of us who teach benefit-cost analysis and advocate its use in public policymaking generally point approvingly to its democratic nature. That is, we argue that BCA is attractive because it is based on the preferences of all those around today.[5] It ought to make us uncomfortable to assert that the discount rate to be used in the DFD approach can be determined independently of the preferences of those whose values we insist be the basis of the benefit and cost estimates.

Implicit in the search for a descriptive discount rate is the view that a single rate can be found that is appropriate for all situations, and that this rate is constant exponentially. Generally, under the descriptive approach, this is the risk free rate of return to invested capital. Yet discount rates surely vary between individuals, as illustrated by research using both

[5] To be sure, we sometimes also lament the preferences of our contemporaries, e.g., when they give rise to the salary differentials that exist between, say, Madonna on the one hand and the country's best high school mathematics teacher on the other. We must also acknowledge that the preferences of the rich receive more weight in BCA than those of the poor. Finally, we must acknowledge that we can only guess in BCA at the values that future generations would attach to various kinds of benefits and costs.

revealed and stated preference methods (see Hausman, 1979; Thaler, 1981; and Cropper, Aydede and Portney, 1994, for example). Ideally, then, one would like an approach to project valuation that takes account of these differences. In fact, it seems likely that the same individual might discount different types of benefits and costs differently. For instance, Cropper, Aydede, and Portney found that individuals responding to questions about the timing of hypothetical life-saving programs revealed relatively high discount rates for lives saved even five years into the future--the median rate among 475 individuals was 16.8 percent, with some individuals revealing much higher rates than this. Although these revealed discount rates for lives saved were similar to the same respondents' revealed discount rates for money, there is no reason to believe that respondents would have traded off future ecosystems preserved, miles of shoreline protected, or other possible benefits or costs for present ones at the same rate(s). Finally, the researchers cited above, as well as others, have found evidence suggesting that individuals do not use a constant exponential rate to discount future gains or losses. Generally, the longer period of time over which the discounting takes place, the lower the discount rate that people apply.

For all these reasons, then, the DFD approach blurs differences between individuals' valuations of environmental benefits and costs, as well as between the rate(s) at which they would trade off their own well-being and that of their fellow-travelers in the present period for that of generations yet unborn. Therefore, the DFD approach to some extent flies in the face of individual choice--the bedrock of modern applied welfare economics. Because these shortcomings are so familiar to us all, we sometimes lose sight of how formidable they are. We turn now to an alternative conception of benefit-cost analysis for intergenerational decisionmaking that avoids these difficulties.

III. THE MOCK REFERENDUM APPROACH

The alternative we propose--the mock referendum--is more tractable than the DFD approach to the analysis of projects with significant intergenerational effects. It is theoretically consistent with notions of preference-based valuation of benefit and cost streams, and also with preference-based discounting of these same streams.

What we have in mind is the following. First, a specific policy proposal is selected for analysis. If global climate change is the problem at issue, the policy might be a tax set at $50 per ton of carbon equivalent, a commitment to stabilize U.S. CO2 emissions at 1990 levels by the year 2010 using marketable permits, or perhaps a commitment by the U.S. to do its part (however that might be determined) to assure the stabilization of atmospheric concentrations of CO2 at some level by the year 2050, using a variety of policy instruments. Whatever the case, note that conventional BCA could be conducted using the DFD approach to evaluate any or all of these proposed policies.

Under the mock referendum approach, however, appeal is made directly to the citizenry for the evaluation of the policy option in question. First, a representative random sample of U.S. households is drawn, a sample that could be partitioned in any number of ways, to be discussed below. This sample would then be presented with a detailed description about what is known about the likely effects of the policy change, and--importantly--what is likely to happen if nothing is done. Among other things, that description would spell out the beneficial effects expected to result from the intervention, and where and when they will occur. Examples might include (but not be limited to) lower global average temperatures, implying less incidence of microbially-induced premature mortality and morbidity, a reduced likelihood

of sea level rise and associated shoreline losses and salt water intrusion into freshwater systems, and less disruption of agricultural and silvacultural activities.

It is important that the sample households be presented with the best information possible about where these effects will be felt. For instance, they should be told that a program that prevents, say, a half-meter increase in sea level rise will do the most good in low-lying undeveloped countries such as Bangladesh (if, in fact, that is what the best science indicates). They might be told that a policy that helps slow forest secession would be especially valuable to some countries or parts of countries, but not to others. And they might be told that the reduced incidence of vector-borne diseases will do the greatest good in tropical countries where these diseases would be most likely to proliferate.

The descriptive material presented to the sample population would also include a description of how the proposed policy intervention would work. That is, it would explain how a tax on carbon equivalents, say, would translate into increased prices for gasoline, home heating oil, electricity, and other products not initially subject to the tax but making use of the taxed products as inputs. Again, it is very important in this description to indicate the spatial distribution of these costs, *including the consequences likely to be borne by the households being surveyed*. In other words, those living in the Midwest who are served by electric utility systems heavily dependent on coal would be told that increased electricity prices in their region are likely to be higher than those in, say, the Pacific Northwest, and by how much. They would also need to be made aware that policies that have their initial cost impacts felt in the U.S. could, nevertheless, affect foreign countries. This could happen, for example, through a reduction in imports from developing countries if tax increases in the U.S. slowed economic growth. Other expected cost impacts would have to be described, as well.

It is quite important that the temporal distribution of impacts be described as carefully as possible. Households would have to be told what favorable and unfavorable impacts are likely to occur immediately, which ones could be expected later in their lives (say, over the next twenty to thirty years), and which impacts are not likely to manifest themselves for hundreds of years. It is equally important that households be given a sense of the uncertainties that attach to the various effects. For instance, they might be told, "Scientists are relatively certain that, in the absence of a reduction in greenhouse gas emissions, any significant increase in sea level is unlikely to occur in the next fifty years. However, effects on agriculture could become evident in this time." They might also be told, to illustrate this point, "While the most likely effect of this policy on energy prices is an X percent increase, there are many who believe that energy conservation and the accelerated adoption of renewable energy sources will make it possible to meet the goals of this policy with much less sacrifice. In fact, there are some experts (a minority) who believe that these policies may end up costing little or nothing."

The material in quotes above would represent a small part of the descriptive material that would be presented to the households being surveyed. Needless to say, great care would have to be taken in preparing this descriptive material, in the same way care is given to the preparation in many cities and states of the materials available to voters in advance of referenda items on state and local ballots. To reiterate, the materials would have to provide the most balanced information possible about the likely benefits and costs, across both space and time, associated with the proposed policy change. This information should also include a description of what other countries will be doing to address the problems associated with climate change. For instance, the materials might indicate that, "In addition to these measures being contemplated in the U.S., other countries including Germany, Japan, Great Britain, France, and

. . . will also be taking similar actions." To get ahead of ourselves a bit here, the descriptive materials that households receive could be varied on this point. For instance, some households might receive materials indicating that, "While the U.S. is moving ahead to address this possible threat, other countries are still deliberating. It is possible that we will be acting alone for some number of years."

The most important respect in which the descriptive material would vary concerns the description of the costs that the household itself is likely to bear, now and in the future. By confronting households with identical information on the likely beneficial effects of the program in space and time, and identical information on the costs that others are likely to bear, while varying for different respondents the description of the costs that they are likely to face, one can sketch out a willingness-to-pay locus for the policy by observing the way their (hypothetical) votes vary with the cost of the program. This is the kernel of our proposed mock referendum approach.

By varying other information provided to subsets of respondents, we can learn how sensitive their votes (or WTP) would be to: (i) the seriousness of the adverse effects likely to result from inaction; (ii) the uncertainties conveyed in the descriptive material; (iii) the timing of the effects; and (iv) their spatial distribution. In addition, because one would also collect information about the respondents' attitudes, incomes, education, and other socioeconomic characteristics, it would be possible to estimate a WTP equation. This in turn would enable the prediction of individual responses in a mock or actual referendum based on a knowledge of individuals' characteristics.

The appeal of this approach, we believe, is that individual "voting" reveals four important bits of information with which one would struggle in the DFD approach. First, the

vote indicates an up-or-down decision on the policy as described to the household, and in this way provides an implicit estimate of the net benefits of a proposed policy. Second, this decision forces the household to aggregate the values it implicitly attaches to the various benefit and cost categories--e.g., the reduced risk of premature mortality in equatorial countries, the reduced likelihood of Kansas farmers suffering income losses, and so on. Third, the mock referendum approach forces each respondent to discount *at its own rate* the benefits and costs that will be felt at different points in time. Thus, for example, a respondent who cares a great deal about those in less developed countries, even those that will inhabit these countries several generations hence, will be more likely to vote yes than one who cares less about what will happen farther away in time and space. In other words, our proposed approach recognizes the heterogeneity of individual preferences on discount rates, rather than forcing the artificial selection of a single rate to use. Fourth, depending on the ambitiousness of the sample size, one can capture all the heterogeneity that exists across households and thus be sure that the results approximate what might happen if an issue such as this were put to a vote. For all these reasons, then, we think the mock referendum approach is more attractive on intellectual grounds than the DFD approach *for these types of problems*.

Note also that our proposed approach is in one sense quite consistent with the "options" view of decisionmaking under great uncertainty.[6] That is, referenda like the one we propose here could be conducted every so often. This would enable one to reflect in the descriptive material provided to respondents any new knowledge or developments relevant to the likely benefits and costs associated with possible policy interventions. Thus, for instance, if

[6] See, for example, the paper by Robert Lind in this same volume.

fuel cells become economically competitive with traditional fossil fuels at a faster rate than is currently anticipated, a mock referendum in ten years would present to respondents more favorable information on the expected costs of the policy. Similarly, if new research in atmospheric chemistry suddenly began to undercut the case for mitigation measures, that, too, could be reflected in the materials provided to respondents in mock referenda. Over time, then, the accretion of new science would influence respondents' votes; it might strengthen the case for certain kinds of protective "hedges," while also suggesting shedding light on the value of options purchased in the past.

There is another reason why the mock referendum approach appeals to us for the analysis of problems with significant intergenerational consequences. It is that it provides the information that must be known if the United States, or any other democracy for that matter, is to take significant actions to reduce emissions of greenhouse gases, begin the construction of radioactive waste repositories, or engage in significant preservation of the habitat of endangered species. To put the matter bluntly, it makes little difference what a benefit-cost analysis premised on the DFD approach says if the American public thinks it silly to spend its money on a program with very speculative benefits that, even should they occur, will go to those in faraway countries hundreds of years hence. Not only does the mock referendum approach provide information on implicit values and rates of time preference, but it also gives us a foreshadowing of what our elected representatives will need to know if and when the time comes to vote on a climate control or other type of program.

IV. PROBLEMS WITH THE MOCK REFERENDUM

We are not so naive as to be blind to the shortcomings of the approach we put forward here. It goes without saying that these are the shortcomings associated with the contingent valuation method. Can we provide respondents with a manageable amount of information sufficient to allow them to cast a minimally informed "vote?" What confidence can we have that their hypothetical votes are at all indicative of what would happen if the decision were really left to them in a national plebiscite? And so on.

We will say little here about this latter question, other than to note that Senator Dole was given virtually no chance by anyone of winning the recent presidential election because opinion polls taken at various times prior to that election indicated that he had very little support. These polls, which were borne out on Election Day, were of course based on respondents' *stated* intentions. We should also note that the DFD approach to benefit-cost analysis does not avoid the problems associated with the absence of revealed preferences. Other than through the use of stated preference approaches, how will the benefits of species preservation, to take but one example, be valued for traditional application of the DFD approach?

We would like to address the former difficulty associated with our proposed approach--namely, how informed could respondents be in our mock referendum if all they are given is several pages of materials describing what might happen in both the presence and the absence of a policy change designed to deal with global climate change, say? This is problematical, of course, especially given the very great uncertainties that attend estimates of physical effects, their associated socioeconomic impacts, the costs of mitigation and adaptation, the time and spatial distribution of effects, and so on. We are under no illusion here that we can provide

respondents with the information available, say, to the experts participating in the IPCC (though they tend to be specialized in their expertise), or even to policymakers in governments contemplating climate mitigation measures.

We do, however, believe it is possible to provide respondents with perhaps as much clear and objective information as would be available to many members of Congress who would be required to vote if significant measures were being contemplated to slow the accumulation of greenhouse gases in the atmosphere. We may be wrong, but it is our conjecture that congressional voting would be relatively uninformed if a measure like one of those described above were brought before our elected representatives. The materials they would be likely to have seen would come from partisans on both sides of the debate; the hearings they may have attended (though this is unlikely) would have featured these same partisans, and perhaps an occasional middle-of-the-roader with five minutes to make his or her point; and the visits they would have been paid would likewise have been from these advocates. We think we can provide information sufficient to allow "voters" to make an intelligent choice in a mock referendum. Will this information be over-simplified? Of course, but no more over-simplified than the information members of Congress will have if and when they are asked to decide on this question.

V. FINAL THOUGHTS

We would be upset if this paper were construed as a rejection of the DFD approach for all environmental policy analysis. To the contrary, we strongly support its use in most environmental decisions, and believe that it can highlight important tradeoffs and make them

transparent to all affected parties. Indeed, it would seem to be a necessary condition for good decisionmaking and we support its widespread application.

However, the class of problem discussed here--those for which many of the important benefits and costs will not arise for hundreds of years or more--may tax traditional BCA beyond its limits. It requires us to make estimates of changes in physical effects (e.g, lives saved, ecosystems preserved, miles of shoreline protected) so far out in time as to be essentially meaningless. It also requires us to come up with values for each and every one of these effects when, we must admit, we can have no very good idea what our distant descendants will and will not value. Of greater relevance to the subject of this workshop, the DFD approach then requires us to select one discount rate to use to telescope these distant benefits and costs back to the present when, in fact, we recognize that each individual trades off future for present well-being (and even different attributes of well-being) at a different rate.

While hardly a panacea, the alternative we propose--a mock referendum--gets around these problems in a way we find attractive. It places the burden of valuation and discounting for intergenerational projects squarely on the shoulders of those who would begin to bear the burdens associated with project implementation--those in the here and now. If repeated regularly, it could be updated as old generations die off and are replaced by new ones. In that regard, it is more consistent with the individualistic underpinnings of applied welfare economics than is the DFD approach. In addition, it mimics the political reality concerning projects with significant intergenerational effects. If the voting public does not regard the uncertain benefits of these projects (benefits that are at least partially remote in both space and time) as being worth the costs that must be borne now, they will not support their adoption, purely and simply.

Why not include in the analytical arsenal a tool that sheds light on valuation, discounting and political acceptability all at the same time? We think a study making use of the mock referendum would be a useful addition to existing analyses of climate mitigation policies, and would be willing to discuss the design and conduct of such a study with any and all interested parties.

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