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Introduction

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The stars would appear to be in alignment once again with regard to **T**he discounting—the technique by which economists and other policy analysts attempt to compare the immediate effects of policy changes (both pro and con) with those occurring in the more distant future. At least two sets of events are interacting to elevate, once again, the visibility of this arcane and often misunderstood, but also quite important, subject.

The first of these events is the international debate about climate change. Many scientists, environmentalists, politicians, and others favor strong action to slow the accumulation of carbon dioxide and the other gases that trap outgoing or terrestrial radiation and, thus, have the potential to warm the earth's atmosphere (the so-called *greenhouse effect*). Even proponents of immediate action, however, readily acknowledge two things. First, the most serious adverse effects that might attend global warming would not occur for decades at the least, and more likely centuries from now. Second, actions taken today to begin addressing this problem will give rise to costs in the here and now. This necessitates some way of comparing, at least qualitatively, these near-term costs with more distant benefits.

Of course, global climate change is not the only problem for which solutions present this pattern of benefits and costs. Within the environmental field alone, both radioactive waste disposal and the preservation of biodiversity have similar profiles of benefits and costs. In the case of the former, the lion's share of the cost of identifying and building a waste disposal site must be incurred up front. Because of the extraordinarily long half-life of radioactive wastes, however, the benefits of safe disposal

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will be felt for tens if not hundreds of thousands of years. For the latter, the costs associated with preserving biodiversity (which often take the form of development benefits forgone) are incurred in the here and now; because once a species is lost, it is lost forever, most of the benefits of successfully preserving it will accrue to later generations. As with climate change, both problems force us to confront how much we are willing to sacrifice today for benefits that will be enjoyed later in our lives or in the lives of succeeding generations.

The growing attention devoted to these types of problems brings us to the second set of events moving discounting back into the policy limelight. Since the late 1970s, and particularly since 1994 when the Republican Party regained control of the U.S. Congress, interest has been growing in expanding the role of benefit-cost analysis (BCA) in federal regulation of the environment, occupational safety and health, and consumer products. (For an excellent history of such efforts and a description of the effects BCA has had on environmental regulation, see Morgenstern 1997.) The spate of regulatory reform legislation introduced in the last five years alone has forced economists and other proponents of BCA to think hard about how it might be applied constructively in rulemakings—especially for the more “exotic” kinds of problems discussed immediately above. At the same time, these legislative debates have positively energized opponents of BCA to focus on its problematic aspects—with valuation and discounting at the very top of the list. For this reason, too, then, discounting is being discussed outside the rather narrow academic circles in which it typically arises.

A TEMPORARY CONSENSUS

This is not the first time, however, that discounting has caught the attention of policymakers. Beginning with the first world oil market upheaval in 1973, the United States and other countries were forced to confront the possibility of making major changes in the ways in which they obtained energy. Among the many policy options under consideration were massive investments in new sources of supply, including the development of very large synthetic fuels plants. Because such facilities would entail huge upfront investments to produce benefits that would not begin to be realized for a number of years (and even then would be spread out over many years), discounting began to attract attention outside of the relatively small group of academics who thought about the comparison of benefits and costs across time.

In 1977, with the support and encouragement of the Electric Power Research Institute (EPRI), Resources for the Future (RFF) convened a con-

ference to discuss the discount rate that ought to be used to evaluate government investments in energy and other technologies. Many of the leading thinkers of the day on this subject were commissioned to write papers; others participated in the conference as discussants or observers.

Nearly four years later, the revised papers, along with a significant contribution by Robert Lind (originally intended only to be a primer to accompany the other papers), were published as a book by RFF (Lind 1982). While the papers in this landmark volume were significant in their own right, it is fair to say that Lind's primer came to assume great importance. This was due in large part to a compromise he proposed in the book on the selection of a discount rate, the origins of which could be traced to Eckstein (1958), Diamond (1968), Feldstein (1970), and especially Bradford (1975). For all intents and purposes, Lind's proposed approach appeared to end at least temporarily disputes about discounting that had gone on for some time. In fact, for fifteen years or so after the publication of the book, when the question "What discount rate should be used to calculate the present value of benefits and costs?" was posed, the standard answer was a brief: "See Lind."

It isn't necessary to attempt here a thorough review of the competing views in 1977 about the appropriate discount rate. Lind's primer performs that service superbly. Similarly, no effort will be made here to spell out in great detail the compromise that Lind proposed. Briefly, though, he pulled together and expressed particularly clearly three important themes that by that time had emerged from the discounting debate. First, to the extent possible, all future benefits and costs should be converted to equivalent changes in consumption for the individuals who will experience them. Second, to the extent that the costs (benefits) of a public investment or regulatory program displace (augment) private capital formation, their consumption-equivalent measure should be adjusted upward to reflect the marginal productivity of capital. And third, these adjusted streams of consumption equivalents should be discounted using the social rate of time preference (or the rate at which society is willing to trade off present for future consumption). Those interested in a fuller and clearer explanation are directed to the book.

In the mid-1990s, however, Lind's apparent compromise seemed to unravel. As part of the ongoing deliberations of the Intergovernmental Panel on Climate Change (IPCC),¹ in 1995 a report was issued that dealt with, among other things, the economic and social ramifications of climate change and policies to address it (IPCC 1995). One chapter of this report was devoted to discounting and intergenerational equity (Arrow and others 1996). While the authors of this very influential chapter cited Lind's 1982 book frequently (among many other references), they made no pretense that a general agreement had been reached on discounting.

Indeed, in their discussion of discounting in benefit-cost analysis, they chose to organize their work by recognizing two opposing schools of thought on the selection of a discount rate, and they made no effort to reconcile the two.

Arrow and others referred to these two schools of thought as the *prescriptive* and the *descriptive* approaches. Under the former, the selection of the discount rate proceeds from what the authors call “ethical principles,” or rules relating to the way that the well-being of different generations ought to be weighed. Under the latter, the choice of a discount rate is based on an observation of the rate(s) of return to capital invested in a variety of alternative assets.² Arrow and others suggest that the prescriptive approach will result in the selection of a lower discount rate than would result from the use of the descriptive approach.³ Once again, or so it seemed, those looking for guidance on the choice of a discount rate could find justification for a rate at or near zero, as high as 20% and any and all values in between.

Into this breach once again stepped RFF, this time with Stanford University’s Energy Modeling Forum (EMF). With support from EPRI, the U.S. Environmental Protection Agency, and the Department of Energy, RFF and EMF sponsored a workshop that brought together many of the world’s best thinkers on discounting, including several who had participated in the conference that RFF had organized nearly two decades before. Climate change was the example that motivated much of the discussion at the workshop, although the conclusions regarding discounting can be generalized to all intergenerational decisionmaking.

Rather than ask the invited participants to write whatever they wanted about the selection of a discount rate, we decided to pose a common set of questions to those writing papers. Specifically, each author was asked the following questions.

- Should projects whose effects will be spread out over hundreds of years or more be treated simply as “longer versions” of projects whose principal effects extend no more than, say, thirty or forty years?
- If the answer to the above question is “yes,” what is the appropriate way to determine the discount rate to be used?
- If projects with significant intergenerational effects are to be valued differently, how should this be done? Should benefits and costs in the distant future not be discounted at all? At a different rate?
- Perhaps more fundamentally, is it appropriate to use benefit-cost analysis at all in decisionmaking on such issues as climate change, disposal of high-level nuclear wastes, and so on?

As readers of this volume will see, some of the conferees dealt rather straightforwardly with these questions, while others addressed them

only by implication. No attempt will be made in this introduction to summarize the papers, all of which were revised, some quite substantially, in the wake of the conference. Some chapters are long, others short. Some are quite technical, others not at all so—but in each chapter, the message of the author(s) or of those commenting on their work will be clear to interested readers.

KEY POINTS

Having attended the workshop, discussed the issues with the participants, read and re-read each of the papers, and thought long and hard about discounting, we have several observations to offer to readers of this volume.

First, it is impossible to read these papers without getting a sense of the unease even the best minds in the profession feel about discounting, due to the technical complexity of the issues and to their ethical ramifications.⁴ This unease is expressed most directly by Robert Solow. In his foreword, he writes, “Maybe the idea of a unitary decisionmaker—like an optimizing individual or a wise and impartial adviser—is not very helpful when it comes to the choice of policies that will have distant-future effects about which one can now know hardly anything.”

There are several reasons for the unease. For one thing, there is no mistaking the very small present value of even very large costs and benefits if they will not be realized for hundreds of years. Assume, for example, that the gross domestic product (GDP) of the world will be \$8 quadrillion in the year 2200 in current dollars.⁵ Suppose next that we want to calculate the present value of that sum using the 7% discount rate that the Office of Management and Budget recommends for such purposes. The answer we get is a surprising \$10 *billion*. In other words, it would not make sense for the world’s present inhabitants to expend more than \$10 billion today (or about \$2 per person) on a measure that would prevent the loss of the entire GDP of the world 200 years from now. No matter how familiar one is with the power of compound interest, it is hard not to be stunned by the small difference that the distant future makes for present-day decisionmaking.

The reason that it would not make sense to spend more than \$10 billion today to safeguard world GDP 200 years from now is clear, of course. It is that we could invest that same \$10 billion at 7% today and have a sum more than sufficient to replace GDP at that time. But this suggests still another concern even hard-nosed benefit-cost analysts have about intertemporal project evaluation: What guarantee is there that the \$10 billion, even if set aside in a fund to replace GDP 200 years hence, will be left

alone during the intervening years? In other words, what if those populating the earth 100 years from now decide to dip into the fund to finance their own consumption? In such a case, those living 200 years from now will have neither the protection of the project we eschewed today nor the fund we created to make them whole because we rejected that project. The fact that we could make them better off with an alternative investment is of little consolation to them if that investment never reaches maturity.

This leads us to another observation about discounting and intergenerational decisionmaking. Although this is not the case for the contributors to this volume, many of those bothered by discounting what Weitzman (1998) calls the “distant future” or the “far distant future” appear to confuse economic efficiency with distributional equity. That is, they seem to forget that a policy action may be unattractive on distributional grounds even if it passes the efficiency test.

To illustrate, consider a policy change for which all of the benefits and costs will be felt immediately. Even if the benefits exceed the costs by a considerable margin, we might reasonably object to the project. This would be so if, first, all the benefits go to the richest five families in the country while all the costs fall on the poorest five, and second, for institutional or other reasons there is no way to compensate the losers out of the gains to the winners.

The same is true for projects the effects of which are spread out through time. Even if it is efficient to reject a climate protection program, say, because it would be cheaper to invest the money in an interest-bearing asset, one might reasonably object to this decision on distributional grounds, especially if one is dubious that the compensation will actually be available to future generations (see Chapter 2 of this volume). At least some of those uncomfortable with the distributional consequences of climate change seem eager to tinker with the discount rate to make mitigation policies pass the efficiency test (when in fact they may not). There is no need to do so—efficiency is hardly the only criterion that matters in policy analysis.

Another very important point comes out of these chapters—one that goes to the very heart of the questions we posed to the participants in the workshop. *With one exception, every chapter in this volume suggests that it is appropriate—indeed essential—to discount future benefits and costs at some positive rate.* Even the one exception—the chapter by Dasgupta, Mäler, and Barrett, in which they envision circumstances in which the discount rate could be zero or even negative—leaves us with the impression that this would be an unusual case.⁶ Even while arguing for a lower discount rate than would be appropriate for a shorter horizon, as many of the chapters here do, the authors quite clearly believe that a failure to discount future

benefits and costs would be a recipe for poor intergenerational policy-making. We take this to be one of the most important conclusions a reader might draw from this volume.

We can make an even stronger statement than this, though. At the workshop, during the discussions surrounding the individual papers and particularly during a wide-ranging discussion involving all the participants that followed the last presentation, virtually everyone agreed on a standard procedure for the evaluation of projects with timeframes of forty years or less. Specifically, they agreed not only that it is appropriate to discount benefits and costs for the purposes of making present value comparisons, but also that the discount rate to use should be one that reflects the opportunity cost of capital. In other words, for projects with horizons shorter than forty years, the conferees were squarely in the *descriptive* camp, to use the language of Arrow in the IPCC report. Beyond this horizon, however, discomfort sets in, and the participants were more willing to entertain somewhat different ways to make decisions (see below).

Another theme pops up in several, though not all, of the papers: analysts may want to use different discount rates depending on the period over which they are calculating net present values. Reference is made to this possibility by Arrow (Chapter 2), Weitzman (Chapter 3), and Kopp and Portney (Chapter 9). Moreover, this idea is the central organizing principle in the essay by Cropper and Laibson (Chapter 16). The possibility of nonconstant discounting is suggested by a growing number of studies in which individuals' discount rates are inferred either from their observed behavior in actual markets (Hausman 1979) or their responses to hypothetical questions about their attitudes toward risk (Horowitz 1991), saving behavior (Thaler 1981), or the life-saving activities of government (Cropper, Aydede, and Portney 1994).⁷ These studies show rather consistently that while individuals do appear to attach lower weights to distant benefits, they not use a constant exponential discount rate. Rather, the longer the time period before effects are felt, the lower the implicit discount rate used.⁸

Finally, and perhaps most surprisingly, at least three of the chapters in this volume explicitly call into question the very utility of the standard welfare-theoretic approach to decisionmaking for climate policy and other problems with significant intergenerational consequences. Schelling, for instance, suggests that we view the problem of climate change in much the same way that we try to decide the right amount of foreign aid to make available to poorer countries each year. His logic is compelling. Most of the costs of mitigating climate change will be borne by the wealthy industrialized countries, while most of the benefits will go to residents of the developing countries, both in the medium and long terms. Thus, as

Schelling sees it, the question is how much will the former sacrifice in the here and now for the benefit of the latter.

Lind is quite sympathetic to Schelling's approach. He compares decisionmaking on climate change to more traditional investment analysis, as in the case of a series of financial options that, once they expire, must be reevaluated (see also Lind and Schuler 1998). While Lind stops short of repudiating the position he set out so elegantly in his 1982 book, for problems like climate change he is clearly wary of policymaking predicated heavily on net present values.

Kopp and Portney take matters one step farther. Sharing Schelling's and Lind's concerns (and perhaps those of other of the participants), they suggest an altogether different approach for decisionmaking in the presence of significant intergenerational effects. Their proposed approach involves a mock referendum, through which is elicited the willingness-to-pay of members of the present generation to reduce the risks to both current and future generations associated with climate change. Aggregate willingness-to-pay (a measure of the current benefits of climate mitigation) would then be compared with the expected costs. This approach would circumvent the need to estimate very long term streams of benefits and costs, as well as the need to choose an appropriate discount rate. Their proposed approach presents formidable problems of its own, however, which would have to be compared with those of the more traditional approach.

FINAL THOUGHTS

What accounts, then, for the reemergence of a schism among economists on the appropriate discount rate for projects extending into the far future? For one thing, the "consensus" described above may have been more apparent than real. After all, the energy crisis—which led to the 1977 conference and Lind's subsequent edited volume—began to abate about the time the book came out. This development probably refocused policymakers' attention on much shorter-term issues for which the choice of a discount rate makes little or no difference. Had the energy crisis not abated, Lind's consensus may have proved to be more fragile than we suggested above.

Greater attention is also being paid these days to distributional questions, prompted by the increasing disparity between the incomes of those at the top and those at the bottom of the income scale. It may be natural at such a time to think not only about intra- and international inequalities in income and wealth, but also about the legacy that we may be leaving for future generations. As soon as one begins to consider policies to affect the latter, up pops the issue of discounting.

We suspect, however, that it is the climate change debate that has economists and others thinking hard once again about the treatment of intergenerational benefits and costs. Should this debate recede into the background (an unlikely prospect, we think), disagreements about whether and at what rate to discount may recede with them. But about two things we feel confident: first, there will always be differing views on the appropriateness of discounting, not to mention the rate to use, and second, a careful reading of the essays in this volume will leave readers better prepared to understand what is being debated and why it is important.

ENDNOTES

1. The IPCC is a large group of scientists from around the world that was convened by the World Meteorological Organization and the United Nations Environment Program to study and provide periodic reports on the possible causes and effects of climate change, as well as the consequences of policies designed to mitigate and/or adapt to these effects.

2. Proponents of the descriptive approach bristle—rightfully so, we believe—at the implication that theirs is an “unethical” tack to take. Indeed, they argue, the reason to use a market-based rate when discounting future benefits and costs is to ensure that society invests in those projects, and only those projects, that leave future generations better off than they would otherwise be.

3. Even small differences in discount rates are important, of course. Because of the power of compound interest, a slightly lower rate could mean that many more investment projects (such as measures to mitigate climate change) will be attractive on grounds of economic efficiency.

4. This unease extends well beyond the contributors to this volume; for instance, see also Chichilnisky 1993 and Heal 1997.

5. This is consistent with an annual growth rate of 3% from current world GDP over the next 200 years.

6. The other authors would agree, we believe, that if per capita consumption were expected to *decline* rather than increase over time, one could justify a zero or even negative discount rate. Since all of modern experience is with gradually *increasing* per capita consumption, however, the most reasonable assumption seems to be that future generations will be better off than the present generation. This forms a rationale for a positive discount rate, incidentally, even if we are unwilling to discount because we feel a greater affinity for generations nearer to ours than for those far removed in time.

7. In a recent paper stimulated by and written subsequent to the 1996 conference, Weitzman has provided a rationale for nonconstant discounting. Moreover, using preferences elicited from more than 1,700 economists and a second set of preferences from fifty of those he considers “experts” on discounting, he has derived a schedule showing the discount rate that is appropriate for particular horizons.

8. Using a discount rate that depends on the period over which the analysis is being conducted is not without problems. For one thing, it leads to time-inconsistent decisions: plans that people will not follow if given the opportunity to reconsider their actions. This property of hyperbolic discounting functions makes many people uneasy about their use in benefit-cost analysis.

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