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Discounting Our Future

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How should we value what the future holds for us? How should we compare a decision, made now, that prevents a harm tomorrow to a decision, made now, that prevents a harm a decade from now? And when the harm to be prevented is human death, does it matter—should it matter—whether, absent our intervention, the death would otherwise occur tomorrow, or a year from now, or a decade from now?

These questions are of central importance in environmental policy today, as it is often thought that, above all, environmental law prevents future harm and preserves future opportunities. To some extent this follows from environmental law's largely preventive, rather than compensatory, focus; it is impossible to prevent a harm that has already happened. But the future orientation of environmental law goes beyond this. What seems to set environmental law apart from other preventive measures is the sheer vastness of the temporal period that appears to separate regulatory action now, such as the removal of a toxic substance from the ambient air, from its full range of beneficial consequences. These consequences include the prevention of long-latency human diseases such as cancer and the prevention of long-term ecological harm. Some of these good consequences may come to the present generation, but perhaps only in later life, many years from now. Others ap-

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pear to accrue only for the benefit of future generations, decades or even centuries from now. In this way, environmental regulation is often contrasted with safety regulation,[1] which, in theory, can begin to save lives as soon as the regulation is in place. A regulation requiring motorcyclists to wear helmets, for example, may save lives the first day it takes effect.

Thus an important question in environmental policy today is how we should value the future when the present, too, cries out for help.[2] As I shall explain, the federal government has embraced an assumption that we value future harms *less* than present harms, and that, even when it comes to human life, the appropriate tradeoff between present and future life-saving can usually be struck by consulting prevailing rates of return on financial investments.[3]

In this article, I explain why I believe that the federal government's current approach to thinking about the future, and to valuing future events for purposes of assessing the wisdom of regulatory actions, is seriously misguided. That approach assumes, first of all, that the benefits of life-saving environmental regulation occur largely in the remote future and, second, that harms prevented in the future are worth less than harms prevented today. The government gives force to these assumptions by subtracting from estimates of future harms a fixed percentage for every year that passes before the harms would otherwise have materialized. According to current government policy, this percentage typically reflects an estimate of the annual rate of return on private investment.[4] This general practice is called discounting, and it is this practice—as applied to the life-saving benefits of environmental regulation—which I call into question here.

Specifically, I argue that the rationales that have been offered in support of discounting in the life-saving context—rationales sounding in individual preferences, opportunity costs, and unintended consequences—rest on shaky empirical and normative foundations. The empirical claims that people prefer remote to immediate hazards, and that the benefits of environmental law accrue largely in the distant future, are inconsistent with existing evidence. The normative assumption that the preferences of individuals acting in their role as consumers should control regulatory outcomes is equally mistaken. I thus conclude that discounting should be abandoned as a

1. *See, e.g.*, John F. Morrall III, *A Review of the Record*, REGULATION, Nov.-Dec. 1986, at 25, 32.

2. *See, e.g.*, Lisa Heinzerling, *Regulatory Costs of Mythic Proportions*, 107 YALE L.J. 1981 (1998); Michael B. Gerrard, *Demons and Angels in Hazardous Waste Regulation: Are Justice, Efficiency, and Democracy Reconcilable?*, 92 NW. U. L. REV. 706, 739-46 (1998).

3. *See, e.g.*, Benefit-Cost Analysis of Federal Programs; Guidelines and Discounts, 57 Fed. Reg. 53,519, 53,522-23 (1992) [hereinafter 1992 Circular A-94].

4. *Id.* at 53,523.

way of evaluating the wisdom of life-saving regulations.

I. INTRODUCTION TO DISCOUNTING

Discounting is the calculation of the present value of a future sum of money. It is typically used in comparing sums of money paid or received over different time periods. By computing the present value of future sums of money, discounting helps an investor choose between investment opportunities. If, for example, one wants to know whether one should pay $10 today for bonds that will pay $20 *five* years from now, or should instead spend the $10 to buy bonds that will pay $30 *ten* years from now, one cannot conclude that the latter investment is better just because thirty is a larger number than twenty. Quite apart from the effect of inflation,[5] the time value of money means that money received later is worth less than the same amount of money received earlier; while one waits for the later money to arrive, one could have been investing the earlier money in some other venture. In addition, one may simply prefer to receive money sooner rather than later because one is anxious to consume the goods money can buy. For both of these reasons (money is productive over time, and people are impatient), in order to compare two investments that pay benefits over different periods of time, one needs not only a common currency (here it is dollars), but one also needs to state that currency in common *temporal* terms. This leads to the idea of computing present value through discounting.[6]

In order to calculate the present value of a future sum of money, one must apply a discount rate to the sum of money one expects to receive, over the period of time one must wait before one receives the money. Thus, the present value of a future sum of money may be described as a function of three variables: the sum of money one expects to receive in the future; the discount rate; and the number of years that will pass before one receives the money.[7] The discount rate depends in large part on which of the rationales for discounting (the productive value of money over time, or simple consumer impatience) applies in a given situation. In evaluating *private* financial projects, economists appear to agree that the appropriate discount rate is the opportunity cost of capital for the investor.[8] In the usual case, this would

5. The "nominal" discount rate takes account of the effect of inflation; the "real" discount rate does not. ZYGMUNT J. B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 61 n.29 (1992).

6. 1992 Circular A-94, *supra* note 3, at 53,520.

7. The general formula for calculating the present value of $\$X$ to be received N years from now when the discount rate is r is: $\$X / (1 + r)^N$. WILLIAM J. BAUMOL & ALAN S. BLINDER, ECONOMICS: PRINCIPLES AND POLICY 612 (6th ed. 1994).

8. PETER S. MENELL & RICHARD B. STEWART, ENVIRONMENTAL LAW AND POLICY 91 (1994).

be the prevailing interest rate.[9]

There is considerable disagreement, however, about the appropriate discount rate for *public* projects, known as the "social discount rate."[10] Indeed, some have suggested that there exists more consensus in the economics literature about the monetary value of a human life—not exactly an uncontroversial matter—than there exists about the social discount rate.[11] Some economists argue that the appropriate discount rate for public projects is the rate of return available for private projects, or the opportunity cost of capital. Others maintain that the right discount rate for public projects is "the rate at which society trades off consumption today for consumption in the future," known as society's rate of time preference.[12] This is, roughly speaking, a measure of consumer impatience rather than an estimate of the opportunity cost of capital. Some people believe that the choice between these alternatives turns on whether a particular public project or program will displace capital investment or private consumption.[13]

Yet a third approach to discounting combines these first two alternatives. This is the "shadow price of capital" approach, which estimates the relative effects of a project on capital investment and consumption, converts these effects into "consumption-equivalents," and discounts the whole amount at the social rate of time preference.[14] Although more complicated than the other discounting approaches I have described, the shadow price of capital approach was long considered the "theoretically preferred" approach to discounting.[15] Recently, however, analysts have begun to express dissatisfaction even with this approach, noting that public projects will necessarily displace private investment only in a "closed" economy, that is, an economy in which capital does not move freely from one investment opportunity to another.[16] In an "open" economy—like the one we enjoy in most contexts—

9. Identifying even this rate can be complicated. *See* EDITH STOKEY & RICHARD ZECKHAUSER, A PRIMER FOR POLICY ANALYSIS 162 (1978) (describing "whole complex of interest rates").

10. For an important early discussion, see William J. Baumol, *On the Social Rate of Discount*, 58 AM. ECON. REV. 789 (1968).

11. Michael J. Moore & W. Kip Viscusi, *Discounting Environmental Health Risks: New Evidence and Policy Implications*, 18 J. ENVTL. ECON. & MGMT. S-51, S-51 (1990).

12. MENELL & STEWART, *supra* note 8, at 91.

13. Clayton P. Gillette & Thomas D. Hopkins, *Federal Agency Valuations of Human Life, in* ADMINISTRATIVE CONFERENCE OF THE U.S., REPORT FOR RECOMMENDATION 88-7, 368, 406 (1988); ROBERT C. LIND ET AL., DISCOUNTING FOR TIME AND RISK IN ENERGY POLICY (1982).

14. For a concise description, see WILLIAM R. CLINE, THE ECONOMICS OF GLOBAL WARMING 243-44 (1992).

15. Economic Analysis of Federal Regulations Under Executive Order 12,866, at pt. III.A.3(b) (Report of Interagency Group Chaired by a Member of the Council of Economic Advisors, (Jan. 11, 1996) [hereinafter Best Practices Manual] (on file with *Land and Water Law Review*).

16. ENVIRONMENTAL PROTECTION AGENCY, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, Review Draft, at E-15 (July 17, 1998) [hereinafter EPA, Draft Cost-Benefit Guidelines] (on file with *Land and Water Law Review*). EPA's July 17, 1998, draft of its revised guidelines for cost-benefit analysis include on every page the following message: "Draft—Do Not Cite or Quote." *Id. passim*. Since this

private investment displaced by a public project will simply surface elsewhere in the economy.[17] On this view, the present value of current public investments should generally be calculated solely according to the social rate of time preference.[18]

In short, although there remains a great deal of controversy about which discounting methodology should be used to evaluate public projects, most current approaches incorporate the social rate of time preference at some point in the analysis. Estimating this rate has also turned out to be complicated. Some analysts have estimated the social rate of time preference based on assumptions about optimal consumer behavior.[19] Others have attempted to derive empirical estimates of the social rate of time preference by investigating consumers' actual decisions. The latter effort has produced decidedly confusing results. Studies of consumer purchases of household appliances, for example, reveal that consumers are exceedingly reluctant to trade off higher prices today for lower costs tomorrow; the discount rate implicit in consumers' decisions about energy efficiency has been found to be as high as 90%.[20] Yet consumers have also proved willing to *save* money at a lower rate of interest than they are simultaneously *paying* for borrowed money, a practice which implies a *negative* discount rate.[21] In the face of this variability, many analysts have chosen, somewhat arbitrarily, to estimate the social rate of time preference by reference to historical rates of return (after taxes and inflation) on relatively riskless investments, such as United States Treasury bonds. Current estimates of these rates of return generally range from 1% to 3%.[22]

The choice between these various approaches to discounting can have significant practical consequences. Based on the rate of return available on private investments, for example, some have argued for a discount rate as high as 25%,[23] with estimates often appearing in the 7% to 10% range. Estimates of the discount rate based on the shadow price of capital have lately

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is a document freely available to the public, however, and since these draft guidelines reflect EPA's most sustained elaboration of its position on discounting to date, I have chosen to cite *and* quote the draft guidelines here.

17. *Id.* at E-16.

18. *Id.* at E-18.

19. Daniel A. Farber & Paul A. Hemmersbaugh, *The Shadow of the Future: Discount Rates, Later Generations, and the Environment*, 46 VAND. L. REV. 267, 284-85 (1993) (suggesting social discount rate of 1% to 2% based on assumptions about optimal savings rates and considered nature of investments reflecting this rate of return).

20. Bernard S. Black & Richard J. Pierce, Jr., *The Choice Between Markets and Central Planning in Regulating the U.S. Electricity Industry*, 93 COLUM. L. REV. 1339, 1365 (1993) (citing research reporting discount rates implicit in energy-efficiency purchases ranging from 50% to 90% for low-income consumers and from 4% to 20% for middle-income consumers).

21. Farber & Hemmersbaugh, *supra* note 19, at 282.

22. EPA, Draft Cost-Benefit Guidelines, *supra* note 16, at E-20 to E-21.

23. Gillette & Hopkins, *supra* note 13, at 406.

dipped as low as 3%,[24] and estimates based on the social rate of time preference have ranged from .5% to 3%.[25]

The larger the discount rate, the smaller future benefits and costs will appear. For instance, the present value of a benefit of $1 million to be received in ten years from now is $900,000 if one uses a 1% discount rate, but only $390,000 if one applies a 10% discount rate.[26] Discounted at 10%, one dollar received fifty years from now is worth slightly less than a penny today–a difference of two orders of magnitude.[27] Even more dramatic, "[i]f one discounts present world GNP over two hundred years at 5% per annum, it is worth only a few hundred thousand dollars, the price of a good apartment. Discounted at 10%, it is equivalent to a used car."[28] High discount rates thus significantly reduce the apparent attractiveness of projects which produce future benefits; low discount rates reduce their attractiveness to a much lesser extent. The following verse, which has been attributed to Kenneth Boulding, captures this idea:

> [T]he long term interest rate
> Determines any project's fate.
> At two percent the case is clear;
> At three, some sneaking doubts appear;
> At four, it draws its final breath;
> While five percent is certain death.[29]

Given this basic dynamic, it is perhaps not surprising to learn that analysts have sometimes manipulated the discount rate they use in evaluating public projects in order to achieve their policy objectives. For example, during the 1950s and 1960s, when the Army Corps of Engineers evaluated its own proposed water resource projects—the benefits of which (electricity production and flood control) were expected to materialize relatively far in the future—it used what others regarded as inappropriately low discount rates, thus inflating the estimated benefits of the projects.[30]

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24. Richard D. Morgenstern, *Conducting an Economic Analysis: Rationale, Issues, and Requirements, in* ECONOMIC ANALYSES AT EPA: ASSESSING REGULATORY IMPACT 36 (Richard D. Morgenstern ed., 1997).

25. Farber & Hemmersbaugh, *supra* note 19, at 282 n.59.

26. *Id.* at 279 (citing PETER G. SASSONE & WILLIAM A. SCHAFFER, COST-BENEFIT ANALYSIS: A HANDBOOK 128 (1978)).

27. Thomas O. McGarity, *Regulatory Analysis and Regulatory Reform*, 65 TEX. L. REV. 1243, 1296 n.293 (1987).

28. Geoffrey Heal, *Interpreting Sustainability, in* SUSTAINABILITY: DYNAMICS AND UNCERTAINTY 7 (Graciela Chichilnisky et al., eds., 1998).

29. McGarity, *supra* note 27, at 1296 n.290.

30. *See, e.g.*, Baumol, *supra* note 10, at 797 n.7; Michael S. Baram, *Cost-Benefit Analysis: An Inadequate Basis for Health, Safety, and Environmental Regulatory Decisionmaking*, 8 ECOL. L.Q. 473, 486 n.47 (1980).

To summarize, the discount rate is a way of expressing, in precise quantitative terms, the relative value of present and future events. In the context of private investments, or public investments in largely financial projects, discounting has been justified as a way of giving force to both the time value of money and consumer impatience. In the next section I discuss current discounting practices, and their justifications, in the context of life-saving regulation.

II. DISCOUNTING AND LIFE-SAVING REGULATION

In the regulatory context, discounting is deployed as part of the cost-benefit analyses performed for major regulations.[31] Thus, the Office of Management and Budget (OMB), which oversees federal agencies' cost-benefit analyses, has developed guidelines for discounting in this context. Most of the federal agencies charged with protecting human health have now, despite some initial reluctance, embraced OMB's policies with respect to discounting. They also appear to embrace OMB's stated rationales for discounting. In justifying discounting in the life-saving context, OMB has invoked individual preferences for present over future benefits, the opportunity costs of incurring costs now in order to reap future benefits, and the absurd consequences that supposedly flow from a failure to discount. I will discuss each of these justifications for discounting in turn, but first, I will briefly describe the federal government's current policy regarding discounting in the life-saving context.

A. Policy

1. *OMB*

OMB has long advocated the use of discounting as a means of placing all of the costs and benefits of federal programs, which may be distributed over different periods of time, on common temporal terms. OMB's Circular A-94, issued in 1972, recommended that federal agencies conducting cost-benefit analyses use a discount rate of 10% in order to translate future costs and benefits into present-value terms.[32] In its early days, OMB's recommendation was applied to situations in which both future costs and benefits reflected commodities routinely traded in markets, and thus these costs and benefits were, uncontroversially, presented in monetary terms. The recom-

31. Cost-benefit analysis is required for major regulations by Executive Order. *See* Exec. Order No. 12,866, 3 C.F.R. 638 (1993), *reprinted in* 5 U.S.C. § 601 app. at 557-61 (1994). President Clinton's 1993 order replaced President Reagan's Executive Order 12,291, which also required cost-benefit analysis. *See id.*

32. Office of Management and Budget, Executive Office of the President, Circular A-94, at 4 (1972) [hereinafter 1972 Circular A-94] (on file with *Land and Water Law Review*).

mendation countered the tendency of some agencies to manipulate the discount rate they used in evaluating public projects in order to enhance the attractiveness of their programs. As I have noted, perhaps the most notorious example of such manipulation was the Army Corps of Engineers' tendency to evaluate water resource projects using inappropriately low discount rates, thus inflating the estimated future benefits of the projects.[33] OMB's 1972 recommendation that agencies use a discount rate of 10% was OMB's "estimate of the average rate of return on private investment, before taxes and after inflation."[34] In other words, OMB based its recommended discount rate on the opportunity cost of capital rather than on some other measure, such as the social rate of time preference.

During the 1980s, a subtle but important shift occurred in OMB's guidance regarding discounting. OMB continued to recommend that agencies discount future costs and benefits when these were stated in monetary terms, but it also began to direct agencies to discount costs and benefits that took the form of goods not directly traded in markets, and even to discount *nonmonetized* costs and benefits, including future human lives saved. This shift is implicitly assumed in OMB's annual reports on federal regulation issued during the 1980s. In its 1987-88 *Regulatory Program of the United States Government*, for example, OMB suggests that in calculating the cost per life saved of its 1984 rule limiting ethylene oxide exposures in the workplace,[35] the Occupational Safety and Health Administration (OSHA) should have discounted the life-saving benefits of its rule.[36] The life-saving benefits of this rule were not monetized,[37] and thus OMB's discounted estimates of these benefits were based on applying a discount rate directly to the number of lives saved, rather than to a sum of money. Also during the 1980s, the question whether to discount nonmonetized future benefits—in particular, human lives saved in the future—played a prominent role in OMB's review of the Environmental Protection Agency's (EPA) rule banning virtually all uses of asbestos.[38] OMB took the position that the EPA

33. *See supra* text accompanying note 30; *see also* CLINE, *supra* note 14, at 267. Interestingly enough, however, OMB's recommendation of a 10% discount rate did not apply to decisions regarding water resource projects. *See* 1972 Circular A-94, *supra* note 32.

34. 1972 Circular A-94, *supra* note 32, at 4.

35. *See* Occupational Exposure to Ethylene Oxide, 49 Fed. Reg. 25,735 (1984) (to be codified at 29 C.F.R. pt. 1910).

36. Office of Management and Budget, Regulatory Program of the United States Government, April 1, 1987 - March 31, 1988, at xxii (1988) [hereinafter Regulatory Program 1987-88] (on file with *Land and Water Law Review*).

37. *Id.* at xx, Table II (reporting relationship between costs and benefits of ethylene oxide rule in terms of costs per life saved, rather than as comparison between monetized costs and benefits).

38. *See* Asbestos; Proposed Mining and Import Restrictions and Proposed Manufacturing, Importation and Processing Prohibitions, 51 Fed. Reg. 3738 (1986) (to be codified at 40 C.F.R. pt. 763) (proposed Jan. 29, 1986). The final asbestos rule, Asbestos; Manufacture, Importation, Processing, and Distribution in Commere Prohibitions, 54 Fed. Reg. 29,460 (1989) (to be codified at 40 C.F.R. pt. 763), was invalidated by the Fifth Circuit. Corrosion Proof Fittings v. EPA, 947 F.2d 1201 (5th Cir. 1991).

should discount the life-saving benefits of its rule, which were stated in terms of total number of lives saved rather than in monetary terms.[39]

During the 1990s, OMB has become more explicit in its recommendation that agencies discount benefits and costs even if they take the form of goods not directly traded in markets, including human lives saved, and even if they are not translated into monetary terms. This advice has spanned administrations in this decade, starting with the Bush administration in the early 1990s[40] and continuing into the Clinton administration. OMB's new guidance for conducting cost-benefit analyses under President Clinton's Executive Order 12,866 explicitly directs agencies to discount non-monetized future costs and benefits, including future health-related benefits.[41] OMB has added a qualification for the treatment of intergenerational effects, noting that in cases in which rules produce costs and/or benefits affecting future generations, discounting is still appropriate, but a different discount rate may be used. Specifically, agencies may use a discount rate which reflects "only the growth of per capita consumption and the corresponding decrease in marginal utility over time."[42] In plain language, this approach to intergenerational discounting assumes that "future generations will be richer than today," and that therefore consumption will be less valuable to them, at the margin, than it is to us today.[43]

Another change in OMB's discounting policies occurred in 1992, when OMB decreased the discount rate recommended for evaluating federal programs from 10% to 7%.[44] The 7% rate is based on OMB's revised estimate of the prevailing (before-tax and after-inflation) rate of return on private investment.[45]

Thus, OMB's recommended discount rate continues to be based on an estimate of the opportunity cost of capital, rather than on the social rate of time preference or the shadow price of capital. Although OMB concedes that the shadow price of capital is the "theoretically preferred" approach to

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39. EPA's Asbestos Regulations: Hearings Before the Subcomm. on Oversight and Investigations of the House Comm. on Energy and Commerce, 99th Cong. 244 (Memorandum from EPA's Milton Russell) [hereinafter EPA's Asbestos Regulations: Hearings].

40. Office of Management and Budget, Regulatory Program of the United States Government, April 1, 1990 - March 31, 1991, at 39-40 (1991) (directing agencies to discount both costs and benefits, even when nonmonetized, and citing individuals' preferences for present over future life-saving) [hereinafter Regulatory Program 1990-91] (on file with *Land and Water Law Review*).

41. Best Practices Manual, *supra* note 15, at pt. III.A.3(a).

42. *Id.* at pt. III.A.3(c).

43. EPA, Draft Cost-Benefit Guidelines, *supra* note 16, at E-23 to E-24. For a critique of this approach to intergenerational decisionmaking, see Thomas C. Schelling, *Intergenerational Discounting*, 23 ENERGY POL'Y 395, 397-400 (1995).

44. 1992 Circular A-94, *supra* note 3, at 53,523.

45. *Id.* at 53,522.

discounting,[46] OMB also recognizes that this approach requires determining "the extent to which government actions—including regulations—crowd out private investment, the social (i.e., before-tax) returns to this investment, and the rate of reinvestment of future yields from current investment."[47] Because each of these determinations is complex, OMB believes that the calculation of the shadow price of capital presents "methodological and empirical challenges" not posed by the calculation of the opportunity cost of capital.[48] While OMB allows agencies to discount using the shadow price of capital in some cases, the agencies must consult OMB before doing so, and must also explain how they resolved the challenges that OMB identifies.[49] Thus, it appears that the default discount rate of 7%, reflecting the opportunity cost of capital, is ultimately premised more on the virtues of simplicity than on the theoretical superiority of the approach to discounting that it embodies.

Beyond setting a recommended discount rate, OMB has also identified the time period over which life-saving benefits should be discounted: agencies evaluating health-based regulations should discount costs and benefits "to reflect the latency period between exposure and illness."[50] This issue arose during OMB's review of the EPA's asbestos ban. OMB took the position that the EPA should, in discounting the life-saving benefits of the rule, account for the average latency period for asbestos-related cancer. This means discounting benefits over a thirty- to forty-year period.[51] For its part, the EPA believed that it was appropriate to discount only from the time when the rule would begin to reduce asbestos exposures, which meant discounting benefits over a one- to ten-year period.[52] The choice between these two discounting intervals can have enormous implications for regulatory policy. Assuming, for purposes of illustration, that a statistical life is worth $1 million, under OMB's approach to discounting the benefits of the asbestos ban, it would not be worth more than $22,000 to prevent one asbestos-related death.[53]

To summarize, OMB currently directs federal agencies conducting cost-benefit analyses of their regulations to discount future costs and benefits at 7% per year, even if these costs or benefits take the form of goods

46. Best Practices Manual, *supra* note 15, at pt. III.A.3(b).
47. *Id.*
48. *Id.*
49. *Id.*
50. *Id.* at pt. III.B.5(a); *see also* Regulatory Program 1987-88, *supra* note 36, at xxii.
51. EPA's Asbestos Regulations: Hearings, *supra* note 39.
52. *Id.*
53. *Id.* at 455. OMB's position on discounting drew sharp criticism from Congress. SUBCOMM. ON OVERSIGHT AND INVESTIGATIONS OF THE HOUSE COMM. ON ENERGY AND COMMERCE, REPORT ON A CASE STUDY ON OMB INTERFERENCE IN AGENCY RULEMAKING 78-79 (Comm. Print 1985).

that are difficult to monetize because they are not directly traded in markets or, indeed, have not been monetized at all. This means that agencies following OMB's advice will either discount what they take to be the monetary value of a human life, or discount each life saved directly, when they are evaluating regulatory activities that save lives in the future. In emphasizing latency periods, OMB also effectively directs agencies to discount the life-saving benefits of their rules from the date on which the illness being prevented (such as cancer) would, absent the regulation, have become clinically evident, since this is the date that marks the end of latency as medical science currently defines it.[54]

2. Federal Agencies

Most of the federal agencies charged with saving human lives now appear to embrace OMB's policies with respect to discounting. They also endorse OMB's basic methodology for valuing human life in monetary terms, which seeks to determine how much individuals are willing to pay (accept) in order to avoid (accept) small increases (reductions) in risk.[55] Thus, in discounting life-saving benefits, the life-saving agencies typically discount what they take to be the monetary value of a human life rather than discounting human lives directly.

The Food and Drug Administration, for example, routinely attaches a monetary value to human lives saved, and also discounts the future life-saving benefits of its rules. It does not, however, always attach the same monetary value to lives saved, nor always discount this value at the same rate.[56] The Consumer Product Safety Commission[57] and the Department of Transportation[58] likewise have endorsed both the practice of monetizing statistical lives and discounting life-saving benefits, although the Department of Transportation has expressed some queasiness about admitting in

54. *See, e.g.*, Kenneth J. Rothman, *Induction and Latent Periods*, 114 AM. J. EPIDEMIOLOGY 253, 254 (1981).

55. Best Practices Manual, *supra* note 15, at pt. III.B.1.

56. *Compare* Regulatory Impact Analysis of the Proposed Rules to Amend the Food Labeling Regulations, 56 Fed. Reg. 60,856 (1991) (valuing statistical life at $1.5 million, and discounting life-saving benefits at 5% per year) *with* Economic Analysis of FDA's Final Rule under Mammography Quality Standards Act of 1992, at 5-26 (valuing statistical life at $5 million, and discounting life-saving benefits at 7% per year).

57. U.S. Consumer Product Safety Commission, Estimating the Cost to Society of Consumer Product Injuries: The Revised Injury Cost Model, at 6-8 (Jan. 1998) [on file with *Land and Water Law Review*]; *see also* Regulatory Analysis of a Revision to Charcoal Labeling, Final Rule, at 5 (Dec. 1995) (describing cost-benefit ratio produced by rule, assuming value of $5 million for a statistical life and a 5% discount rate for future life-saving benefits) [on file with *Land and Water Law Review*].

58. U.S. Department of Transportation, Memorandum from Walter B. McCormick, Jr., et al., to Assistant Secretaries and Modal Administrators, Treatment of Value of Life and Injuries in Preparing Economic Evaluations, at 3, 6 (Jan. 8, 1993) (embracing value of statistical life of $2.5 million and discount rate of 7%) [hereinafter McCormick Memo].

public documents that it has done so.[59] For its part, OSHA appears to be the lone no-discounting holdout among the life-saving agencies. OSHA neither monetizes the value of a human life, nor discounts human lives directly.[60]

Most important for present purposes, the EPA has, despite some initial hesitancy,[61] apparently come to accept the notion that future costs and benefits should be routinely discounted to reflect what the agency takes to be their lower worth as compared to present costs and benefits. The agency also now appears to accept the idea that the value of statistical lives can and should be stated in monetary terms. The EPA has embraced monetization and discounting both in its revised general guidelines for cost-benefit analyses (now in draft form), and in the cost-benefit analyses conducted for recent rulemakings.

The EPA's new guidelines on cost-benefit analysis contain an exhaustive review of the existing economics literature on discounting.[62] In the end, the EPA embraces a discount rate of 2% to 3% for both intra- and intergenerational costs and benefits. For intergenerational effects it also specifies that economic analyses should include a "no discounting" scenario.[63] For intragenerational effects, the EPA indicates that it will include a cost-benefit scenario using OMB's recommended 7% discount rate.[64]

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59. An internal Department of Transportation memo states:

> Under limited circumstances, computational procedures in investment analysis may require insertion of an explicit value for fatalities averted. In such cases, the WTP value can be used, but the accompanying text should avoid implying that the Department has set a dollar price on lives or injuries. *Rather than saying something like, 'The Office of the Secretary has set the value of life at $2.5 million dollars . . .,' the preferable language would be more like, 'Economic research indicates that $2.5 million per statistical life saved is a reasonable estimate of people's willingness to pay for safety.'*"

See id. at 4 (emphasis added).

60. OSHA has long refused to assign a monetary value to human life, and thus takes the position that discounting the life-saving benefits of its rules would be inappropriate. Telephone Interview with Thomas Mochler, Economist, Office of Regulatory Analysis, Department of Policy, OSHA (Feb. 1998). I have found one rulemaking in which OSHA, "for illustrative purposes," noted how existing estimates of the value of a human life, discounted at 10% per year, would affect the cost-benefit ratio of one of its rules, Safety Standards for Fall Protection in the Construction Industry, 51 Fed. Reg. 42,718 (to be codified at 29 C.F.R. pt. 1926) (proposed Nov. 25, 1986), but in other cases OSHA has not discounted the life-saving benefits of its rules. *See* Regulatory Program 1987-88, *supra* note 36, at xvii, Table I.

61. *See supra* text accompanying note 52 (discussing EPA's position on discounting in context of asbestos ban).

62. *See* EPA, Draft Cost-Benefit Guidelines, *supra* note 16, Appendix E.

63. *See id.* at E-22 (intragenerational effects), E-28 (intergenerational effects). EPA indicates that discounting in the intergenerational context is *not* appropriate in the following circumstances: (1) "[c]osts and benefits are very large and separated by substantial amounts of time"; (2) "[d]iscounting masks great uncertainties in attempting to value future preferences"; and (3) "[f]uture impacts are subject to enormous uncertainties." *Id.* at E-25.

64. *Id.* at E-22.

Thus, like OMB, the EPA has opted for discount rates (2% to 3% and 7%) reflecting constant exponential discounting. That is, these discount rates remain constant over time so that benefits accruing fifty years from now will be discounted at the same rate as benefits accruing 500 years from now.[65] Moreover, the discount rates exponentially reduce future benefits, an operation akin to compound interest in reverse.

Despite the importance of hard-to-monetize or non-monetized benefits—such as human life and natural resources—to all of its work, the EPA devotes relatively little attention in its draft cost-benefit guidelines to the special problems discounting might pose with respect to such benefits. The agency does note two arguments that have been raised against discounting these kinds of benefits. First, some have argued that discounting damages to human lives or natural resources "treats these tangible risk-related benefits as monetary outcomes, when they are not in fact financial consequences."[66] Second, the agency acknowledges, some have argued that it is "ethically unacceptable to discount physical units. If, for example, cancer cases that occur in the future are discounted to the present, this effectively asserts that a future cancer case is not really a cancer case, but rather is only 80%, 20%, or some other fraction of a 'full' current cancer case."[67] Despite these objections, the EPA ultimately embraces the discounting of benefits relating to human health and natural resources, whether they are monetized or not. If certain regulatory effects "correspond to endpoints that are normally monetized," the agency directs that these effects (such as effects on human health and the environment), even if not monetized, should themselves be discounted to reflect the fact that "effects that are felt farther in the future are worth less in today's terms than those [that] occur earlier in time."[68]

In its draft guidelines, the EPA does not address the important question of the date from which regulatory benefits should be discounted. Unlike OMB, which, as I have noted, has said that life-saving benefits should be discounted from the end of the latency period of the relevant disease, the EPA has not explicitly stated whether life-saving benefits should be discounted from the date when the latency period ends, or from some other date. However, a tiny hint of the EPA's current position on this issue comes from the agency's cost-benefit analysis of the new air quality standards for particulate matter and ozone. There, the EPA indicated that if it could iden-

65. *See also* Maureen L. Cropper, et al., *Discounting Human Lives*, 1991 AM. J. AGR. ECON. 1410, 1411 ("Constant exponential discounting implies that the discount factor applied to a life saved at $T = 100$ to discount it to $T = 50$ is the same one applied to a life saved at $T = 50$ to discount it to the present ($T = 0$).").

66. EPA, Draft Cost-Benefit Guidelines, *supra* note 16, at E-28.

67. *Id.* at E-29.

68. *Id.*

tify the lag time between exposure to these pollutants and effects on mortality, discounting the mortality-related benefits of the new standards would be appropriate.[69] This suggests, perhaps, that the EPA has come to share OMB's view that life-saving benefits should be discounted from the date when the health effects prevented by a regulation would have appeared in the absence of the regulation, that is, from the end of the latency period of the illness in question.

While its new guidelines for cost-benefit analysis are not yet final, the EPA has in some cases already discounted life-saving benefits in evaluating its major rules. However, the EPA's discounting practices to date have not been uniform. Many of the agency's cost-benefit analyses have applied discounting only to costs and not to benefits, or have not employed discounting at all.[70] Even when discounting has been used, discount rates have varied, ranging from 3% to 10%.[71] In most cases where the EPA has discounted life-saving benefits, it has also monetized these benefits (including statistical lives saved), so that the commodity it has discounted has been a sum of money. I am aware of only one case in which the EPA discounted lives saved, rather than what it took to be the monetary equivalent of a human life, and that was in its cost-benefit analysis of its ill-fated ban on asbestos.[72] In that case, the EPA discounted future lives saved from the date on which exposures to asbestos would be reduced, rather than from the date on which the latency period for asbestos-related disease would end.[73] As indicated above, however, more recent evidence suggests that the agency may now believe it appropriate to discount from the date on which adverse health effects appear rather than from the date on which risky exposures are reduced.[74]

B. Theory

Both OMB and the federal agencies charged with saving lives have offered several different theories as to why it is appropriate, even essential,

69. U.S. EPA, Regulatory Impact Analysis of the Revisions to the National Ambient Air Quality Standards for Ozone and Particulate Matter, at 12-71 (July 1997).

70. *See, e.g.*, U.S. EPA, Regulatory Impact Analysis of the Part 503 Sewage Sludge Regulation (1992).

71. *See* U.S. EPA, Economic Analysis for the National Emissions Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production; Effluent Limitations Guidelines, Pretreatment Standards and New Source Performance Standards: Pulp, Paper and Paperboard Category–Phase I at 4-23 (1997) (discounting benefits at 3% and 7%); U.S. EPA, Regulatory Impact Analysis of § 402(a) and § 404 of Lead Exposure Reduction to the Toxic Substances Control Act at 6-27 to 6-28 (1996) (discounting benefits at 3%); U.S. EPA, Regulatory Impact Analysis of Controls on Asbestos and Asbestos Products at II-18 (1989) (discounting benefits at 3%); U.S. EPA, Regulatory Impact Analysis of Costs and Benefits of Reducing Lead in Gasoline at V-39 (1985) (discounting benefits at 10%).

72. *See* EPA's Asbestos Regulations: Hearings, *supra* note 39.

73. *Id.*

74. *Id.*

to discount the life-saving benefits of regulation.

1. *OMB*

OMB supports discounting in part by invoking the "time value of money," which implies that "[b]enefits and costs are worth more if they are experienced sooner."[75] This rationale leads naturally to OMB's embrace of a 7% discount rate, calculated by estimating the average rate of return on private financial investments. This rate reflects the time value of money.[76]

Obviously, however, human health and human lives do not compound in the same way money does. Thus OMB has found it necessary to explain why, even if the benefits of regulation are not monetized or are hard to monetize, they, too, should be discounted at the prevailing rate of return on private investment. OMB believes that critics of discounting have overdrawn the distinction between monetized and nonmonetized goods. "[A]ll goods of finite value," OMB insists, are "amenable to monetization. Individuals behave in accordance with real prices where prices exist, and *as if* prices exist in areas where they do not. The relevant distinction between monetizable and nonmonetizable effects is really one of the ease with which one can estimate their value."[77] OMB observes that empirical research has found that "individuals behave as if they discount future effects that do not carry explicit prices."[78] OMB cites studies estimating that workers discount future health effects from workplace hazards by 10% to 12% per year.[79] Thus, OMB's rationale for discounting the nonmonetized or hard-to-monetize life-saving benefits of regulation is essentially the same one that underlies the case for discounting in general: individuals have, in their actual decisions, expressed a preference for current benefits over future benefits, and we should respect that preference in evaluating the wisdom of regulation.

OMB also justifies the discounting of nonmonetized or hard-to-monetize benefits by describing the "absurd result" that would follow from a failure to discount these benefits. OMB explains that the failure to discount would mean that

> society will always be better off by deferring an action (and its associated benefits) indefinitely. To argue that a nonmonetized benefit should not be discounted implies that its value is the same whether

75. 1992 Circular A-94, *supra* note 3, at 53,522; *see also* Regulatory Program 1990-91, *supra* note 40, app. V at 657; Regulatory Program 1987-88, *supra* note 36, at 35-36.
76. 1992 Circular A-94, *supra* note 3, at 53,522.
77. Regulatory Program 1990-91, *supra* note 40, at 39-40.
78. *Id.* at 40.
79. *Id.*

> it occurs today or at any time in the future. Suppose that the resources that would otherwise be used today to achieve a given result could be invested at a positive rate of return (that is, at the discount rate). By forgoing the expense this year and investing the resources at the discount rate, society could spend more next year (by a proportion equal to the discount rate) and achieve a higher level of welfare. As long as society places the same value on a unit of future benefits as a unit of current benefits (i.e., it does not discount), it will be better off by delaying the action ad infinitum.[80]

Clearly, this is not an argument in favor of a particular discount rate, but one in favor of discounting in general. Without discounting, OMB believes, we would be tempted to put off all life-saving interventions indefinitely.

To summarize, OMB has justified discounting in the life-saving context by invoking the two rationales commonly offered for discounting in general: money produces more money over time, and thus money received in the future is worth less than money received today (even if the money in question represents the value of human life); and people would prefer to receive a benefit sooner rather than later (even if the benefit in question is a reduction in health risk). The first rationale is a function of the properties of money in our economic system; the second purports to be a function of our expressed preferences. In addition, OMB has defended discounting against its critics by claiming that, absent discounting, the government would be justified in continually postponing life-saving interventions.[81]

2. Federal Agencies

Most of the federal agencies charged with saving lives have only glancingly explained their endorsement of discounting. The Food and Drug Administration, for example, has simply stated that discounting reflects "the value that consumers place today on future benefits," and that "it is necessary to discount benefits in order to be able to compare them to costs."[82]

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80. *Id.*; *see also* Emmett B. Keeler & Shan Cretin, *Discounting of Life-Saving and Other Nonmonetary Effects*, 29 MGT. SCI. 300 (1983).

81. OMB has rejected one of the rationales sometimes offered in favor of discounting, which is that future costs and benefits are more uncertain than present ones. Medical advances might, for example, mitigate or even cure the diseases regulation is designed to prevent, and thus a regulation's future health-related benefits might turn out to be lower than predicted. *See, e.g.*, John F. Morrall III, *Cotton Dust: An Economist's View, in* THE SCIENTIFIC BASIS OF HEALTH AND SAFETY REGULATION 107-08 (Robert W. Crandall & Lester B. Lave eds., 1981). As OMB has explained, however, "[i]t is conceptually incorrect to adjust the discount rate as a device to account for the uncertainty of expected future benefits and costs." Regulatory Program 1990-91, *supra* note 40, at 658. Instead, OMB has stated, uncertainty should be taken into account directly by, among other things, engaging in sensitivity analysis. *Id.* at 658; Best Practices Manual, *supra* note 15, at pt. III.A.3(a). *See also* Heinzerling, *supra* note 2, at 2044-46.

82. Regulatory Impact Analysis of the Proposed Rules to Amend the Food Labeling Regulations, 56 Fed. Reg. 60,856, 60,856-57 (1991).

Similarly, the Consumer Product Safety Commission has justified discounting future health-related benefits by noting that it "correctly models health decision-making described in general population surveys and revealed by safety behavior."[83] The Department of Transportation has likewise sufficed with the observation that life-saving benefits "should be discounted to reflect the fact that expected future benefits are valued less highly by society than immediate benefits."[84]

The EPA has provided by far the most extensive justification of discounting. Like the other life-saving agencies, the EPA has defended discounting in the intragenerational context mainly by reference to people's preferences for present benefits over future ones: "a given amount of future consumption is worth less than the same amount of consumption today."[85] This general preference, the EPA has observed, holds true even with respect to nonmonetized benefits like benefits to human health. The agency cites surveys finding that people apply a positive discount rate to nonmonetized future effects, that is, they "prefer projects that save lives in the near term over equivalent cost projects that save lives in the future."[86] Unlike the other agencies, the EPA has also explained why people's preferences are relevant to decisions about discounting:

> Just as consumer sovereignty dictates that the government should incorporate the specific values that particular individuals place on outcomes that affect them in assessing its actions, the government should also discount future costs and benefits in the same way that the affected individuals do. Strict adherence to the principles of consumer sovereignty is necessary in order to determine how much each person would agree he or she is made better or worse off by a given policy in present value terms.[87]

Citing individual preferences, the EPA has proposed discounting life-saving benefits at the rate at which individuals actually trade off present for future consumption, that is, the social rate of time preference. The EPA believes this rate is reflected in the rate of return on relatively risk-free private investment, such as investment in Treasury bonds.[88]

In justifying discounting in general, the EPA also has invoked the same argument from absurdity that OMB has stressed. Responding to arguments

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83. Consumer Product Safety Commission, *supra* note 57, at 8.
84. McCormick Memo, *supra* note 58, at 8.
85. EPA, Draft Cost-Benefit Guidelines, *supra* note 16, at E-1.
86. *Id.* at E-29 to E-30; *see also id.* at E-25.
87. *Id.* at E-9.
88. *Id.* at E-20.

that certain benefits, including health-related benefits and benefits to future generations, should not be discounted at all, the EPA offers the following example:

> Suppose, for example, there is a policy that is estimated to save five lives in the year it is implemented. This policy can either be implemented today (option A) or 20 years from now (option B), and the undiscounted costs in current dollars are the same for both options. If the discounted costs are compared with undiscounted benefits, a cost-effectiveness evaluation will clearly favor option B. Thus, failing to discount benefits can produce a situation in which society has little motive to pursue current environmental benefits because by investing instead, larger net environmental benefits can be gained in the more distant future.[89]

Thus, like OMB, the EPA contends that discounting is necessary in order to avoid "irrational, or intrinsically unappealing" results.[90]

However, the EPA criticizes OMB's notion that the rate of return on private investment—the opportunity cost of capital—should be used to estimate the social discount rate. As the EPA explains:

> Social welfare will be improved if the government invests in projects that have higher values than if it invests in lower value ones. . . .
>
> However, it does not follow that rates of return offered by alternative private or public projects define the level of the social discount rate. An alternative project might produce large benefits over the future, and thus offer a large "rate of return." But if individuals discount these future benefits using the consumption rate of interest, the correct way to describe this project is that it offers substantial present value net benefits. In general, the opportunity cost argument is not about the social discount rate *per se*, but about correctly and consistently examining the social values of all alternatives. . . . [A]n alternative project with a high rate of return will have a high social net present value. But this does not imply that its rate of return should become the social rate of discount to be used for pure time discounting for other projects.[91]

Thus the EPA rejects basing the discount rate on the opportunity cost of

89. *Id.* at E-29; *see also id.* at E-27 (justifying discounting in the intergenerational context in order to avoid the conclusion that "the most desirable policy is never to spend the funds and to accumulate instead an ever-growing pool of resources to provide benefits to the ever more distant future").

90. *Id.* at E-29.

91. *Id.* at E-15.

capital (the basis for OMB's recommended 7% discount rate), opting instead for a discount rate based on the social rate of time preference, which the EPA takes to be reflected in the rate of return on relatively riskless investment.[92] In the end, therefore, the EPA's reasons for embracing discounting largely sound in individual preferences and unintended consequences.

Preferences, lost opportunities, and unintended consequences thus dominate the government's case in favor of discounting the life-saving benefits of regulation. In the sections that follow, I discuss the empirical and normative shortcomings of these rationales.[93]

III. PREFERENCES

One of the primary justifications for discounting in the life-saving context is that it reflects people's preferences about risk. This argument rests on premises which are flawed from both empirical and normative perspectives.

A. Empirical Evidence

The argument from preferences assumes that when people make decisions about risk, they prefer, predictably and systematically, to avoid a hazard that will materialize in harm today to avoiding one that will materialize in harm at a later date. The empirical evidence of people's actual preferences is, however, considerably more mixed than this argument suggests.

In fact, empirical research on intertemporal choice has found that sometimes people prefer to suffer a negative consequence *sooner* rather than later. In one study, for example, subjects were asked to identify "the most you would pay now" to avoid a non-lethal electric shock in five different time periods: immediately, and following delays of three hours, one day, three days, one year, and ten years.[94] Subjects proved "willing to pay substantially more to avoid a shock to be received in one or ten years than one in the immediate future."[95] Similarly, subjects asked to identify the least amount of money they would demand for cleaning 100 hamster cages within the following week and one year from that time revealed that they

92. *Id.* at E-21.

93. The discussion that follows is drawn in part from Heinzerling, *Regulatory Costs of Mythic Proportions*, *supra* note 2, and Lisa Heinzerling, *Environmental Law and the Present Future*, 87 GEO. L.J. (forthcoming 1999).

94. Richard H. Thaler & George Loewenstein, *Intertemporal Choice*, *in* THE WINNER'S CURSE: PARADOXES AND ANOMALIES OF ECONOMIC LIFE 92, 104 (Richard H. Thaler ed., 1992).

95. *Id.*

would demand *more* for postponing the unpleasant task.[96] Studies like these seem to confirm the commonsense notion that, far from preferring to postpone unpleasant events, many people would like to get them over with as soon as possible.

One might expect, however, that when the harm in question is death, rather than temporary unpleasantness, most people would prefer to delay it as long as possible.[97] Here, too, though, the empirical evidence on preferences is surprising, and highly varied. I note at the outset that this empirical evidence is very limited; only a handful of studies have explored the factual accuracy of the claim that people prefer immediate to remote physical harms.

Some researchers have attempted to determine individuals' discount rates for risk by identifying the discount rate implicit in market decisions about risk. These studies consider the extent to which people are willing to accept compensation in return for an increased risk of physical harm. They have *assumed* that individuals discount future harms at a constant exponential rate, and have tried to determine what that rate is. The discount rates found in these studies have covered a wide range, from approximately 2%[98] to 17%.[99]

Other researchers have used direct surveys to determine individuals' discount rates, rather than attempting to derive an implicit discount rate from observed market behavior. These surveys have attempted to identify individuals' discount rates by questioning respondents about their relative preferences for present-oriented and future-oriented life-saving programs. The present-oriented programs have typically been described as saving fewer lives than the future-oriented programs, so that respondents must choose between a lower level of immediate life-saving and a higher level of more remote life-saving. Some researchers using this technique have found median discount rates for risk ranging from 4.5% to 12.8%.[100] When other

96. *Id.* at 105.

97. Louis Anthony Cox, Jr., *Theory of Regulatory Benefits Assessment: Econometric and Expressed Preference Approaches, in* BENEFITS ASSESSMENT: THE STATE OF THE ART 145 (Bentkover et al. eds., 1986) (stating that individuals' temporal preferences may depend on whether effects in question are reversible; if they are, individuals might want to get them over with as soon as possible).

98. *See* Michael J. Moore & W. Kip Viscusi, *Discounting Environmental Health Risks: New Evidence and Policy Implications*, 18 J. ENVTL. ECON. & MGMT., at S-51, S-59 (1990).

99. *See, e.g.*, W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK 55, 145 (1992) (finding the discount rate for future health "in the vicinity of" 11%); Mark K. Dreyfus & W. Kip Viscusi, *Rates of Time Preference and Consumer Valuations of Automobile Safety and Fuel Efficiency*, 38 J.L. & ECON. 79, 98-99 (1995) (finding an implicit discount rate of 11% to 17% in private consumption decisions with respect to automobile safety).

100. John K. Horowitz & Richard T. Carson, *Discounting Statistical Lives*, 3 J. RISK & UNCERTAINTY 403, 410 (1990).

analysts using direct surveys have relaxed the assumption of constant exponential discounting, they have found that individuals reveal *lower* discount rates for *longer* time horizons. That is, individuals' discount rates tend to decline, according to this research, the further out into the future the relevant effects will occur. For example, respondents in one oft-cited study indicated that they would, on average, discount future lives saved at approximately 8% per year if the lives would be saved within twenty-five years, but would discount lives saved at only about 3% per year if the lives would be saved within 100 years.[101] This suggests that the respondents, on average, value lives saved in the distant future more highly than they value lives saved in the near future. Such evidence is consistent with the numerous studies finding that, in the context of monetary rewards and penalties, individuals do not discount at a constant rate over time; instead the discount rates implicit in their decisions decline with time.[102]

The discount rates I have reported from the empirical literature are the mean or median rates found in this research. It is important to realize that individual responses in these studies varied widely. In two studies using direct survey techniques, approximately one-third of the respondents did not discount future life-saving at all as compared to present life-saving.[103] Indeed, in one of the studies, 10% of the respondents revealed *negative* discount rates—meaning they attached *more* value to future than to present lives.[104] Yet approximately 40% of the respondents in the same study appeared to prefer "the present-oriented program no matter how many lives were saved in the future"—meaning, perhaps, they attached *no* value to future lives saved.[105] When questioned more closely, about half of these respondents indicated that their preference for the present-oriented program derived from their belief that "lives in the future will be saved some other way," implying that they believed it would not prove necessary to trade off present for future lives.[106]

These empirical studies pose numerous problems for the argument that discounting future life-saving is appropriate because it reflects people's preferences. First of all, the few available empirical studies show, at the very most, that the risk-related decisions of a majority of people do indeed

101. *See* Cropper et al., *supra* note 65, at 1413.

102. *See, e.g.*,George Loewenstein & Drazen Prelec, *Anomalies in Intertemporal Choice: Evidence and an Interpretation*, 107 Q. J. ECON. 573 (1992); Richard Thaler, *Some Empirical Evidence on Dynamic Inconsistency*, 8 ECON. LETTERS 201, 205 (1981).

103. Horowitz & Carson, *supra* note 100, at 410; Ola Svenson & Gunnar Karlsson, *Decision-Making, Time Horizons, and Risk in the Very Long-Term Perspective*, 9 RISK ANALYSIS 385, 396 (1989).

104. Cropper, et al., *supra* note 65, at 1412.

105. *Id.*

106. *Id.* When these respondents were excluded from the study's results, median discount rates declined to 0% at 100 years, 3.5% at 50 years, and 7% at year 0. *See id.* at 1413.

reflect discounting. They do not, however, bring us anywhere close to being able to identify a single *rate* at which people discount future risk-related effects. Although W. Kip Viscusi and Michael Moore (the authors of studies evaluating discount rates implicit in risk-related wage premiums) have argued that the discount rates found in their studies—ranging from 2% to 12%—"lie in a fairly narrow range,"[107] in fact the difference between these two extremes has huge implications for regulatory policy. Discounted at 2% per year, 100 lives saved fifty years from now are the equivalent of approximately thirty-seven lives saved today. Discounted at 10%, they are equivalent to about *one-third of one life* saved today, a difference of over two orders of magnitude.[108] It is scarcely reassuring to learn that "the confidence intervals for the discount rate estimates overlap available market rates of return."[109] Estimates of market rates of return themselves vary considerably,[110] and the large range spanned by the confidence intervals simply highlights the uncertainty of the median discount rates reported by these studies.

A second problem with the empirical evidence on discounting is that at least some of this research—specifically, the Moore and Viscusi studies—*assumed* that individuals discount risk-related benefits at a constant exponential rate. These studies tell us nothing about whether discounting reflects people's preferences, because the studies assume that people's preference is to discount. The studies purport only to tell us, if we discount, at what rate we should discount. And again, the rates they identify inhabit too wide a range to be helpful in setting regulatory policy.

Problems also exist with respect to the studies using direct survey techniques to elicit individuals' risk-related discount rates. Most fundamentally, the methodology of these studies conflicts with the reasons for consulting individual preferences in the first place. The EPA explains its emphasis on individual preferences by invoking "consumer sovereignty," which "dictates that the government should discount future costs and benefits in the same way that *the affected individuals* do."[111] But in the studies using direct survey techniques, respondents were not asked how they valued future risk-related benefits *accruing to them.* This is particularly evident in the studies evaluating discount rates over such a long period of time that the respondents cannot possibly have expected to be alive by the time the future-oriented programs began to save lives; few adults, I think, expect to be

107. Moore & Viscusi, *supra* note 98, at S-61.

108. The general formula for calculating the present value of $\$X$ to be received N years from now when the discount rate is r is: $\$X / (1 + r)^N$. *See* BAUMOL & BLINDER, *supra* note 7.

109. Moore & Viscusi, *supra* note 98, at S-61.

110. *See supra* notes 23-25 and accompanying text.

111. EPA, Draft Cost-Benefit Guidelines, *supra* note 16, at 22.

alive 100 years from now.[112] Even with respect to those programs that began to save lives within the expected lifetime of the survey respondents, it is not clear that respondents were evaluating risk-related benefits that would accrue to themselves; not all people, for example, travel in airplanes,[113] nor do all people expect to be able to enjoy life-saving benefits accruing even twenty-five years from now.[114] As a result, these surveys may not measure *temporal* preferences so much as they measure individuals' preferences for their own lives and those of people whom they know, as compared to the lives of people (temporally) distant from them.[115]

Equally important, it is not at all clear that privately conducted surveys designed to elicit what is, in essence, a policy position—how many lives would we have to save in X years from now in order to justify forgoing a program saving Y lives today—capture citizens' preferences, as citizens, better than the environmental laws we have enacted over the past thirty years. The issue of discounting arises in the environmental context only because our government has enacted environmental laws which look to the future as much as to the present. It is not obvious why these laws are not themselves evidence of a resistance to discounting on the part of the citizenry, and why they should not be deemed more informative about citizens' risk-related temporal preferences than the results of twelve- to fifteen-minute telephone interviews[116] conducted in a total of 3,200 American households.[117]

In addition, some studies using direct survey methods have abstracted from the nature of the risk in question in order to isolate the effect of time alone on risk-related preferences. Cropper and her coauthors, for example, asked survey respondents to choose between a program that would prevent 100 people from dying this year "from pollution" and a program that would prevent 200 people from dying from the same general cause fifty years from now.[118] The authors report that their question was "deliberately abstract" in

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112. Cropper, et al., *supra* note 65, at 1412 (indicating that the survey horizon extends 100 years into future).

113. Horowitz & Carson, *supra* note 100, at 408 (indicating that the survey sought to elicit discount rates implicit in decisions about airline safety).

114. Cropper, et al., *supra* note 65, at 1412 (indicating that the study included 25-year time horizon).

115. *Cf.* Schelling, *supra* note 43, at 396 ("[T]ime may serve as a kind of measure of 'distance' . . . . To be less interested in the welfare of East Africans than former Yugoslavians is less like 'discounting' than, perhaps, 'depreciating'. When we count future welfare less than our own we are depreciating generations that are distant in time, in familiarity, in culture, in kinship, and along other dimensions. . . . The crucial point is that these are not 'saving' decisions we are talking about, but decisions about redistributing income–our income.").

116. Maureen L. Cropper, et al., *Rates of Time Preference for Saving Lives*, 1992 AM. ECON. REV. 469, 472.

117. *Id.* at 469.

118. Cropper et al., *supra* note 65, at 1410.

order "to focus attention on the timing of lives saved, rather than on the cause of the deaths avoided." By abstracting from the specific nature of the risk, however, Cropper and her co-authors ignored the possibility that risk-related temporal preferences are partly a function of the nature of the risk in question, and thus individuals' discount rates for one type of risk may tell us little about their discount rates for another type of risk.

Indeed, Cropper and her co-authors found, in pretests, that "references to real-world programs such as Superfund clean-ups and nuclear waste disposal caused people to focus on these aspects of the question rather than on the number of lives saved and the time at which they were saved."[119] Other evidence also suggests that individuals' risk-related discount rates depend on the nature of the risk in question. Horowitz and Carson, for example, found that discount rates in the context of traffic safety were almost three times as high as discount rates in the context of workplace safety and airline safety.[120] Other researchers have likewise found that the nature of the risk influences temporal preferences for risk reduction.[121] While these findings are important, probably none of these studies fully captures the importance of the nature of the risk in question to individuals' temporal preferences. Each study asked respondents to consider the *same type* of risk over different temporal intervals.[122] None of the studies gave respondents the opportunity to reject discounting based on a comparison of different types of risk. Yet it is possible that individuals discount future effects when these are compared to present effects of the same nature, but that they would not do so if the future effects were qualitatively different, in an important way, from present effects. For example, surveys asking individuals to compare *different* types of risk over different temporal intervals—like surveys asking people whether they would prefer to prevent ten deaths in automobile accidents today, or to prevent twenty deaths that would otherwise follow, after a latency period of twenty years, from today's exposures to toxic chemicals—might better capture the importance of the nature of risk to individuals' temporal preferences.

Especially given that discounting often underlies analyses used to justify the reallocating of risk-reduction resources from one type of risk to another—such as the transfer of government resources from hazardous waste cleanup to vaccination programs[123]—it is inappropriate to abstract from the

119. *Id.*

120. Horowitz & Carson, *supra* note 100, at 410.

121. Svenson & Karlsson, *supra* note 103, at 385 ("Substantial proportions of all [respondent] groups regarded negative consequences related to nuclear waste as nondiscountable.").

122. Horowitz & Carson, *supra* note 100, at 408, 412 n.9 (describing survey questions).

123. STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION 23-28 (1993).

nature of the risk in determining individuals' risk-related discount rates. If discount rates differ across risks, then one cannot use the discount rates implicit in decisions about one type of risk to set discount rates to be used in evaluating the regulation of another type of risk.

The possibility that discount rates differ for different kinds of risks is consistent with the research exploring laypeople's perceptions of risk. This research has concluded that laypeople take more than numerical estimates of the probability and magnitude of harm into account in judging risk. These considerations are by now well known: the controllability, familiarity, immediacy, diffuseness, voluntariness, equity, reversibility, and naturalness of the hazard, or the converse of these characteristics, all appear to help shape lay perceptions of risk.[124] Laypeople also appear to care about whether a hazard threatens only this generation, or also future generations, and appear to perceive the latter kind of hazard as riskier than the former.[125]

Thus it appears that citizens' anxieties about a particular substance or activity do not depend on the immediacy of the physical harm that might be done by it. Indeed, in many cases there appears to be an inverse relationship between anxiety and immediacy. To perceive more risk from hazards that pose threats to future generations than to ones that threaten this generation alone, and to worry more about latent hazards than immediate ones, is obviously to reserve a special dread for the remote threat of harm. Less obviously, considerations such as equity, controllability, knowability, and reversibility also have a large temporal dimension. A long passage of time between the imposition of a risk and the manifestation of physical harm makes inequity more likely, insofar as those who benefited from the risk are less likely to be around to suffer the consequences of having imposed it. In addition, it is harder to control and to understand a threat if its consequences cannot be perceived until many years after one acts.[126] One's ability to engage in trial and error—a time-honored technique for controlling and learning about a hazard—is severely diminished by a large temporal gap between the trial and the error.[127] It is also more difficult to reverse a threat

124. *See, e.g.*, Paul Slovic, *Perception of Risk*, 236 SCIENCE 280, 283 (1987); WILLIAM W. LOWRANCE, OF ACCEPTABLE RISK: SCIENCE AND THE DETERMINATION OF SAFETY 87 fg.3-1 (1976); Robin Gregory & Robert Mendelsohn, *Perceived Risk, Dread, and Benefits*, 13 RISK ANALYSIS 259 (1993) (using regression techniques to identify major explanatory variables for risk perceptions reported by laypeople in other studies).

125. Gregory & Mendelsohn, *supra* note 124, at 261.

126. HENRY M. VYNER, INVISIBLE TRAUMA: THE PSYCHOSOCIAL EFFECTS OF INVISIBLE ENVIRONMENTAL CONTAMINANTS 14-18 (1988) (arguing that environmental contaminants that are "invisible" for a long time due to the long latency periods of diseases caused by them are less amenable to adaptation and control by people exposed to such contaminants).

127. Clayton P. Gillette & James E. Krier, *Risks, Courts, and Agencies*, 138 U. PENN. L. REV. 1027, 1077, 1107 (1990). *See also* Laura M. Davidson, et al., *Toxic Exposure and Chronic Stress at Three Mile Island, in* 6 ADVANCES IN ENVIRONMENTAL PSYCHOLOGY: EXPOSURE TO HAZARDOUS SUBSTANCES:

that has been many years in the making,[128] and that arises—as many environmental hazards do—from durable agents that, once unleashed, persist in the environment and in living tissue for many years.[129]

The nature of a risk thus matters a great deal in citizens' perceptions of that risk, and the features of a risk that matter to citizens have a great deal to do with *time*. One cannot, without distortion, abstract from the nature of a risk in seeking to elicit citizens' risk-related temporal preferences. Yet this is precisely what studies purporting to find that discounting reflects preferences have done. Furthermore, the empirical research on lay perceptions of risk is in conflict with the factual premise of the argument from preferences, which is that people systematically prefer remote to immediate risks. Indeed, this research suggests that people sometimes fear activities and substances that produce remote health effects *more* than they fear activities and substances that produce immediate effects.

The empirical evidence used to support the preference-based argument for discounting is riddled with problems. Careful analysis of the limited data available on individuals' risk-related discount rates reveals that a substantial percentage of citizens do not discount future health-related harms; that those who do, do so at wildly different rates, and at rates that decline with time; that much of the evidence purporting to find that individuals prefer remote harms to immediate ones in fact only shows that individuals prefer that others be hurt instead of themselves; and that individuals' risk-related preferences depend in part on the nature of the risk in question. For all of these reasons, the preference-based argument for discounting is, empirically speaking, very weak. This argument also rests on dubious normative foundations.

B. Normative Premise

The preference-based argument for discounting holds that individuals' risk-related temporal preferences, as revealed or expressed in their roles as consumers, should control the government's treatment of the temporal dimension in risk regulation. The normative premise of this kind of argument is that "the government ought not, at least as a general rule, to be in the

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PSYCHOLOGICAL PARAMETERS 35, 44 (Allen H. Lebovits, et al., eds., 1986) (explaining that uncertainty about future consequences of past exposures to harmful agents may increase perceptions of loss of control).

128. *See* Michael Gaffney & Bernard Altshuler, *Public Health Implications of Carcinogenic Exposure Under the Multistage Model*, 124 AM. J. EPIDEMIOLOGY 1021, 1029 (1986) (arguing that, because early-stage carcinogens take longer to do their harmful work, many years of exposure will be accumulated by the time epidemiological studies reveal their harmful consequences, and at that point, it is too late to repair the damage that has been done).

129. LOWRANCE, *supra* note 124, at 93-94.

business of evaluating whether a person's choice will serve his or her interests, or even whether the choice is objectionable, except when the choice causes harm to others."[130]

By its own terms, this justification does not embrace one person's preference for another person's harm. Thus, it cannot support discounting in the intergenerational context, in which people's preferences for current life-saving over future life-saving merely reflect a preference for self-protection over protection of others. Nor can it support discounting even in the intragenerational context, if the preferences invoked in support of discounting are based on the implicit assumption that the people doing the preferring are not themselves going to be the ones affected by their preferences. Although both OMB and EPA have acknowledged that the intergenerational setting may pose special challenges for discounting, both also ultimately embrace a default discount rate, even in this setting, based on an estimate of the preferences of the people living today for the present over the future. Moreover, both have defended their assumption that discounting comports with individual preferences, in the intragenerational context, by reference to empirical studies that, as I discussed above, appear also to reveal people's preferences for their own health over others' health as much as they reveal people's temporal preferences with respect to health outcomes affecting themselves.

In any event, saying that a particular government decision reflects private preferences cannot conclude the debate over regulatory policy. A vast portion of our regulatory state interferes with private preferences, and a correspondingly vast literature has emerged to defend it.[131] It now seems incontestable that private preferences, revealed in people's capacity as consumers, may not reflect public preferences, revealed in people's capacity as citizens.[132] The divergence between the preferences expressed in these different contexts may, indeed, be *most* pronounced in the case of temporal preferences.[133]

For example, Americans are notoriously bad at saving money on their own.[134] But Social Security is arguably the most popular entitlement pro-

130. *See* Cass R. Sunstein, *Legal Interference with Private Preferences*, 53 U. CHI. L. REV. 1129, 1131-32 (1986); *see also* EPA, Draft Cost-Benefit Guidelines, *supra* note 16, at E-9 (emphasizing "consumer sovereignty").

131. For an important discussion of the justifications for government interference with private preferences, *see generally* Sunstein, *supra* note 130.

132. *See, e.g.*, Mark Sagoff, *On Markets for Risk*, 41 MD. L. REV. 755 (1982).

133. *See, e.g.*, Sunstein, *supra* note 130, at 1161-66 (discussing justifications for legal interference with private preferences that relate specifically to citizens' limited temporal horizons).

134. Farber & Hemmersbaugh, *supra* note 19, at 284-85 (citing "broad consensus among economists and the public that American savings rates are . . . too low.").

gram in the United States. It is hard to explain the tension between Americans' personal saving habits, and their enthusiasm for Social Security, by reference to anything other than a divergence between the temporal preferences of people as consumers and as citizens:[135] people appear to "prefer society in its collective decisions to be longer sighted than any individual would be in his own decisions."[136] Citizens do not want the government in its collective decisions to give in to the "faulty telescopic faculty" that they exhibit in their private lives.[137] Thus private preferences for current over future consumption—or health—should not be used to subvert a public judgment that future harms are as important as immediate ones.

Moreover, although the EPA has purported to embrace discounting on account of "consumer sovereignty," in fact it is the rational actor, not the representative consumer, who reigns supreme in the agency's discounting practices. There are many different consumer savings decisions which might be taken to reflect the social rate of time preference.[138] Yet of all the savings decisions the EPA might have used to determine the social rate of time preference, it happened to choose the after-tax market rate of interest, the very rate that standard economic theory tells us the rational person would choose for a discount rate.[139] Instead, the EPA might have estimated the social rate of time preference based on the discount rates implicit in decisions whether to purchase energy-efficient appliances, which range as high as 90%.[140] Moving in the other direction, the agency might have estimated the social rate of time preference based on the discount rate implicit in the decision to receive a tax refund at the end of the year (rather than have less money withheld from each paycheck throughout the year), which reflects a *negative* discount rate.[141] In a world where people daily violate the standard economic assumption that they will discount future money streams at the prevailing market rate of interest, there is no neutral way to pick just one of the many discount rates reflected in their decisions and call *that* the social rate of time preference.

Thus, when it comes to discounting the life-saving benefits of environmental regulation, the consumer is not the sovereign, the rational actor is. What is more, the rational actor isn't even very rational. Franco Modigliani won the Nobel Prize in economics for his development of the "life-

135. Richard H. Thaler, *Savings, Fungibility, and Mental Accounts, in* THE WINNER'S CURSE: PARADOXES AND ANOMALIES OF ECONOMIC LIFE, 107, 109 (1992) ("The Social Security system, perhaps the most popular social policy of this century, is an example of legislated self-control.").

136. Cox, *supra* note 97, at 151.

137. A.C. PIGOU, THE ECONOMICS OF WELFARE 23-30 (4th ed. 1932).

138. *See supra* notes 19-22 and accompanying text.

139. Thaler & Loewenstein, *supra* note 94, at 93.

140. *See supra* note 20.

141. Thaler & Loewenstein, *supra* note 94, at 93.

cycle theory"—now the "standard model of saving in economics"[142]—which holds that individuals value consumption equally in every period of their lives and that they will accordingly consume in any given year an amount equivalent to the annuity that could be purchased given the present value of their financial wealth.[143] Consumer impatience—the very engine that drives the effort to define the social rate of time preference—is a *departure from* this standard economic account of human behavior.[144] So is the fact that people lack self-control and thus find it necessary to "take steps to constrain their future behavior," *including pressing for passage of social legislation that protects them from the consequences of their own lack of self-control.*[145] In setting a discount rate driven by consumer impatience and simultaneously asserting that "consumer sovereignty" should define the importance of the future relative to the present in setting public policy, the EPA has thus acknowledged one violation of standard economic theory (people are impatient) while at the same time refusing to acknowledge another (people commonly try to control their impatience through, among other things, social legislation). This asymmetry makes it possible for the EPA to give force to consumer impatience without at the same time acknowledging that many people may be looking to EPA itself to temper that impatience.

Discounting seems inconsistent with rational behavior in another way as well, at least if the term "rational" can be applied to behavior which, though it violates standard tenets of economic theory, would be regarded by most people as sound and sensible. In the view of many, one of the hallmarks of maturity is the capacity to form habits that, in the short run, are difficult to maintain but that, over the long run, help a person to grow and to flourish. Habits of diet and exercise, of learning and hard work, of frugality in spending and generosity in love—all of these take discipline and dedication to form. Yet most people, I think, would agree that these are the kinds of habits they admire, even the kind they wish to pass on to their children. It is difficult, maybe impossible, to form such habits—which must depend on a kind of presumption that the future is as important as the present—while simultaneously believing that the future should be discounted, or depreciated, relative to the present. Thus the discounting embraced by the federal government ultimately fails to promote a compelling conception of human rationality.

142. Thaler, *supra* note 135, at 107.
143. *Id.* at 107-08.
144. *Id.* at 109.
145. *Id.*

III. OPPORTUNITIES

Aside from invoking preferences, OMB and the EPA also have cited opportunity costs in justifying discounting in the life-saving context. If we do not discount future life-saving benefits, the argument goes, we will miss opportunities to achieve the same good results with less money, or even more good results with the same amount of money.[146] Kip Viscusi illustrates this argument with the following example:

> Suppose . . . policy A saves five expected lives now and policy B saves five expected lives ten years from now. Each policy costs $15 million. . . . Policy A is clearly more attractive because it saves five lives now for a cost at the time the lives are saved of $15 million. In contrast, policy B saves the five lives a decade from now, but the cost *at the time the lives are saved* is the $15 million invested this year plus any accrued interest over the next decade on this investment. Therefore, the cost per life saved during the year that lives are being saved will be greater for policy B.[147]

As Viscusi implies, to calculate the opportunity cost of life-saving interventions, one may either *discount* estimates of benefits from the date on which benefits accrue, back to the date on which the costs of producing them will be incurred, or *appreciate* present-value estimates of costs forward to the date on which the benefits they produce will accrue. Both techniques—discounting benefits and appreciating costs—have the same operative effect.[148]

Appreciating costs does, however, appear to have one advantage over discounting: it may elide the normative issues involved in determining the relative value of present and future events. It is, in a sense, the truest measure of opportunity costs. The task is to determine how much a regulation "really" costs to reduce a risk by measuring the cost of that regulation as of the date it produces benefits so that this present-value cost may be compared to the present-value costs of alternative actions. Appreciating costs does not appear to require an assumption that future benefits are worth less than present ones.

However, neither appreciating nor discounting can be done unless one knows how long one must wait before receiving the relevant benefit. As a consequence, the practice also requires quite precise identification of what the relevant benefit or cost is, and when it occurs. In the environmental

146. *See, e.g.*, Farber & Hemmersbaugh, *supra* note 19, at 280, 287.
147. W. Kip Viscusi, *Equivalent Frames of Reference for Judging Risk Regulation Policies*, 3 N.Y.U. ENVTL. L.J. 431, 436-37 (1995) (emphasis added).
148. *Id.* at 437 n.16.

context, this precision has typically been achieved at the expense of accuracy.

Most cost-benefit analyses of life-saving regulations single out, for precise quantification, one regulatory benefit among many. In most cases, this benefit has been the prevention of human death from one cause, cancer.[149] These analyses then go on to assume that the date on which this benefit accrues is the date on which the life-threatening illness—in most cases cancer—would otherwise have become clinically detectable.[150] This procedure both necessitates and facilitates discounting. It necessitates discounting because the long latency periods associated with human cancer make the benefits of preventing cancer—as long as those benefits are defined to accrue only when the disease would otherwise have become manifest—appear remote in time. The procedure facilitates discounting because without identifying a quite precise date on which regulatory benefits accrue, discounting is unworkable.

The singleminded focus on quantified cancer deaths ignores the many health-related benefits of environmental law that either cannot be quantified or do not lead to death. A large number of adverse health conditions, beyond cancer, have been linked to exposure to harmful environmental agents. These include rashes, blemishes, and other skin disorders; nausea; headaches; vision loss; decreased lung function; disorders of the respiratory, neurological, endocrine, and gastrointestinal systems; hematological disorders such as anemia; reproductive dysfunctions including decreased reproductive capacity and higher rates of miscarriage; birth defects; impaired cognitive functioning and development; and chromosomal abnormalities.[151] The large range of illnesses prevented by environmental regulation means that the benefits of environmental regulation are distributed over a wide temporal range, stretching from the immediate present to the distant future. For example, skin disorders, breathing troubles, headaches, and the like often follow soon after exposure occurs.[152] Indeed, such symptoms often provide the first clues that something is amiss in the environment. These early effects are typically followed by a range of chronic conditions that result from the steady accumulation of harmful exposures; health conditions such as anemia and various neurological disorders would fall in this intermediate temporal range. Last to appear are generally the cancers and other

149. *See* Heinzerling, *supra* note 2, at 2060-61.

150. OMB has explicitly stated that agencies should discount life-saving benefits by considering the latency period associated with the diseases being prevented by regulation. Best Practices Manual, *supra* note 15, at pt. III.B.5(a).

151. *See* Heinzerling, *Environmental Law and the Present Future*, *supra* note 93.

152. *See, e.g., Habitability of the Love Canal Area: An Analysis of the Technical Basis for the Decision on the Habitability of the Emergency Declaration Area—A Technical Memorandum*, Office of Technology Assessment, OTA-TM-M-13, at 45 (June 1983).

health conditions whose symptoms do not become overt until years after the process of disease has been initiated. In these cases, a disease may have begun its deadly course long before anyone can detect it.

Temporally speaking, therefore, the physical consequences of the many varieties of environmentally related disease together occupy a lengthy continuum. Moreover, even within the context of a single disease such as cancer, this temporal dynamic holds true. That is, the physical events relating to the development of cancer typically stretch over a long period, ranging from the first exposure to a substance bearing the potential to transform a normal cell into a cancerous one, to the development of overt symptoms of disease, including death. The moments in this timeline that should most concern regulators are the moments of increased risk and disease initiation, not the moment when an existing disease happens to become clinically detectable. By the time a cancerous growth is large enough to be detectable, it may already have spread to other areas of the body and, as a consequence, may be impossible to control.[153] Moreover, by the time the cancer develops to the point where the cancer itself causes overt physical symptoms like nausea or headaches, it will often be past the point of remedy.[154] The onset of disease, in other words, may precede by many years the capacity to detect it. For the regulator interested in preventing human illness, the crucial period in the development of disease should be the period during which the process of disease is initiated. It is only during this period that the regulator has a chance actually to prevent the disease, rather than merely react to it once it has developed.

The discounters in the environmental context have erred both by fixating on only one of the many benefits of environmental law (the prevention of cancer) and by picking the wrong moment from which to discount this one benefit (the end of the latency period). They might try to rehabilitate the practice of discounting by saying that they have picked this particular moment out of necessity. Science has not yet advanced to the point where it can identify the precise moment when a long-developing disease (like cancer) is initiated.[155] Thus, if one wants to discount, one cannot use the moment of disease initiation in order to do so because discounting requires a quite precise definition of the moment when benefits accrue. Discounters might therefore argue that regulatory analysis is forced, out of necessity, to

153. For a sobering assessment of the current state of cancer treatment, see John C. Bailar III & Heather L. Gornik, *Cancer Undefeated*, 336 N. ENG. J. MED. 1569 (1997).

154. Jerry B. Buchanan et al., *Tumor Growth, Doubling Times, and the Inability of the Radiologist to Diagnose Certain Cancers*, 21 RADIOLOGIC CLIN. NO. AM. 115, 119-20 (1983). Certainly, at least, removing cancerous growth becomes harder–"more difficult, more costly, more disfiguring, and less effective"–the further the cancer has progressed. *Id.* at 120.

155. *See* David F. Goldsmith, *Calculating Cancer Latency Using Data from a Nested Case-Control Study of Prostatic Cancer*, 40 J. CHRON. DIS. 119S, 122S (1987).

use an identifiable moment (like clinical detectability) to mark the moment when regulatory benefits accrue. But we need to mark this moment precisely only if we decide to discount. One reason we should not discount is that we cannot mark this moment precisely and accurately at the same time.

There is, however, one moment we can identify with both precision and accuracy, and that is the moment when risk is reduced. Risk is reduced as soon as exposures to harmful environmental agents are reduced. Thus one might argue that discounting, if it is to be done at all, should be done only over the interval between the time when costs for risk reduction are expended and the time when risk reduction actually begins.[156] This approach would be consistent with the current methodology for valuing the very goods being discounted, which are the benefits of life-saving regulation. That methodology asks how much individuals would be willing to pay (or to accept) in order to avoid (or suffer) a small increase in the probability of death.[157] This amount is then divided by the probability of harm in order to produce the value of a single "statistical life."[158] However, the commodity being valued is the small reduction (or increase) in *risk*, not life itself.[159]

The government's current approaches to valuation and discounting are inconsistent with each other. When the government discounts, it assumes that the moment when life-saving environmental regulation confers a benefit is the moment when physical illness would otherwise have become patent, not the moment when risk is reduced. When the government attaches a monetary value to the benefits of life-saving regulation, however, it assumes that the benefit being conferred is a reduction in risk. Thus, the government discounts life-saving benefits not from the date of a reduction in risk, but from the date on which disease would have become patent in the absence of regulation, even though what it is discounting—typically, the monetary value of a statistical life[160]—is derived by considering the value of a reduction in risk.

Discounting the life-saving benefits of environmental law could be made both practicable, and consistent with current methods for valuing human life, by discounting from the date of the reduction in risk accomplished by environmental regulation rather than from the date of clinical detection in an unregulated environment. Even with this adjustment, discounting remains problematic in light of a proper account of the temporal distribution

156. *See* Heinzerling, *supra* note 2, at 2054.

157. *See, e.g.*, W. KIP VISCUSI, RATIONAL RISK POLICY 45 (1998).

158. *See id.* at 46. The same result can be achieved by multiplying the probability of harm by the number of people necessary to produce one death, given the probability of harm. *See id.*

159. *See, e.g., id.* at 45.

160. *See* Best Practices Manual, *supra* note 15, at pt. II.A.2.

of the benefits of environmental law. The reduction in risk is by no means the only benefit of life-saving environmental regulations; the prevention of illness and death are also important benefits. Any analysis which isolates a single benefit, and discounts from the date on which that benefit accrues, will inadequately capture the full range of benefits conferred by environmental law.

IV. UNINTENDED CONSEQUENCES

Both OMB and the EPA believe that a failure to discount would lead to unintended and absurd consequences. They have suggested that unless we discount the future benefits of life-saving regulation, we will always postpone life-saving regulation indefinitely because we will always be able to argue that the pot of money we might spend today will only grow with time and therefore can be put to greater use the further into the future regulation is delayed.[161]

There are several problems with this argument. First, the argument assumes, inconsistent with experience, that the costs of life-saving regulation will not increase faster than the rate implied by market rates of interest. If they do increase faster than this rate, then we will not improve our life-saving capabilities by investing money now to spend it later. But the costs of environmental protection likely increase the longer one waits to address the relevant problem. Given more time, for example, untreated hazardous waste has more chance to escape from its original location—say, a landfill—into areas where it can do more harm—like the groundwater—and where it will be more expensive to mitigate. And, given more time, pollution-producing habits, such as industrial processes or consumer lifestyles, become more entrenched and more difficult and costly to give up. The point here is simply that the longer we wait to address an environmental problem, the costlier the solution is likely to become. The argument from unintended consequences errs by assuming that the costs of life-saving regulation will remain stable over time.

A second problem with the argument from absurdity is that it assumes that we can achieve the same regulatory purposes by postponing regulation as by acting now.[162] This is not the case.[163] The gradual, cumulative nature of many environmental risks means that we cannot wait until disease or death

161. *See, e.g.*, Regulatory Program 1990-91, *supra* note 36, at 40.

162. *See* Keeler & Cretin, *supra* note 80, at 303 (analysis showing that a failure to discount justifies postponing life-saving programs indefinitely depends on assumption that "the possibilities for producing benefits do not decrease over time," and that *"any feasible program . . . can be delayed"*) (emphasis added).

163. *See* Heinzerling, *Environmental Law and the Present Future*, *supra* note 93.

is upon us to act. Moreover, the persistent nature of many environmental threats makes it impossible to reduce the risk from them by acting later. And the formation of habits now will entrench practices that have future effects. What we do now, in other words, may make people sick, or even kill them, many years from now, but by the time that day nears it will be impossible to do anything to prevent it. In these circumstances, postponing regulation amounts to an admission of defeat. By assuming that we can achieve the same regulatory benefits, no matter when we begin, the argument from unintended consequences ignores the long timeline associated with many environmental problems.

Of course, if one regards *any* life-saving strategy as achieving the same benefits as another, so long as it saves as many lives as the other, then the argument from absurdity survives this second challenge. Even if one waits until the last minute to regulate, one could always save lives by requiring, for example, a new traffic safety feature that, in theory, could begin to save lives immediately upon installation. But so long as one recognizes that the nature of a risk matters in calculating the benefits of preventing it—that a death from bungee jumping is not the moral equivalent of a death from benzene vapors—then it remains true that one cannot substantially postpone environmental regulation and still achieve the same regulatory benefits as one would have achieved by acting earlier.

Finally, the argument from absurdity depends on the idea that, without discounting of the kind I have been discussing, we would be *forced*—always—to prefer saving more lives in the future over saving fewer lives today if both life-saving results could be achieved at the same cost. This just assumes that the relevant decisionmaker has the same blind devotion to numbers as many of the people who advocate discounting do. One could decide that saving fewer lives today is better than saving slightly more lives tomorrow without, at the same time, embracing the technique of applying a fixed yearly discount rate to future lives saved. The argument from absurdity depends, ultimately, on a play on words: Because we will undoubtedly sometimes prefer today's lives over tomorrow's—thus "discounting" the importance of tomorrow's lives relative to today's—we must embrace "discounting" in the sense it is understood by economists, that is, the reduction of future benefits by a yearly percentage that remains fixed across contexts. This proposition avoids being a *non sequitur* only if it is tied to the equally dubious proposition that the only way to think rationally is to think quantitatively.

V. CONCLUSION

The Environmental Protection Agency has now embraced the practice of discounting the future life-saving benefits of its rules. It has also endorsed the notion that the relative worth of present and future life saving can be determined by consulting rates of return on financial investments. These are unfortunate developments. They reflect neither the considered preferences of citizens when it comes to matters of risk, nor an accurate account of the temporal distribution of the benefits of environmental law. There is, indeed, a jarring asymmetry between EPA's coolly confident claim that "effects that occur farther in the future are worth less in today's terms than those that occur earlier in time"[164] and the widespread impression that environmental law was developed, and the EPA created, precisely in order to protect ourselves and future generations from this kind of myopia.

164. EPA, Draft Cost-Benefit Guidelines, *supra* note 16, at 25.