ADMINISTRATIVE CONFERENCE OF
THE UNITED STATES

Report for
RECOMMENDATION 88-7

FEDERAL AGENCY VALUATIONS OF HUMAN LIFE

by

Clayton P. Gillette

Professor of Law
Boston University School of Law

and

Thomas D. Hopkins

Gosnell Professor of Economics
Rochester Institute of Technology

December 1988

I. Introduction

Regulation of health and safety hazards provides protection at a price. Using regulation to decrease the number or severity of accidents, injuries, and illnesses typically requires the expenditure of societal resources. Notwithstanding the benefits that can be conferred by these expenditures, the limited nature of available resources means that their dedication to this purpose requires forgoing alternative uses. Thus, decisions to take advantage of an opportunity for risk reduction necessarily confronts the issue: is the reduction worth the cost? Put in the extreme, this question asks what we as a society are willing to invest in order to save lives, or -- more crudely -- what price we place on human life. As harsh or cold-blooded as this inquiry might seem, it is both a common and necessary part of government regulation of hazards.

The inevitability of this issue does not suggest, however, that all regulators will define the "value of life" equally or even similarly. Indeed, there is substantial evidence that federal agencies differ widely on life valuation questions that determine the propriety of a particular regulation. Some agencies employ explicit valuations of life in determining the relative benefits of a proposed regulation, while other agencies eschew any such calculation. Even the latter, of course, reveal an implicit value that can be inferred by computing the cost of a regulation and the number of lives that would be saved through its adoption. Our discussions with agency officials suggest that where explicit figures are used there recently has been convergence around a figure of $1-2 million per statistical life. For instance, economists at the Consumer Product Safety Commission utilize that range.[1] Nevertheless, agencies have used substantially varying numbers in calculating the benefits of particular regulations. EPA staff have employed figures between $400,000 and $7 million.[2] The Nuclear Regulatory Commission has adopted a somewhat different approach; it evaluates the "value-impact" of proposed regulations by assigning a monetary value of $1000 per person-rem that would be averted by a given proposal.[3] By one calculation, NRC's figure translates into $7.4 million per fatality averted.[4]

Agencies that do not adopt explicit values of life may still predict both the cost of implementing a proposed regulation and the number of lives that would thereby be saved. The implicit cost of regulation per life saved derived from these figures permits some inference about the value of life assumed in agency action or inaction. For example, the Office of Management and Budget[5] has documented values per life saved in discrete rulemakings ranging as low as $70,000 (in a 1980 Consumer Product Safety Commission regulation of space heaters) and as high as $132,000,000 (in a 1979 regulation of the Food

---

1 See, e.g., Memorandum from Paul Rubin to L.J. Sharman, May 27, 1987.

2 Conversation of authors with Ralph A. Luken, Chief, Economic Studies Branch, Environmental Protection Agency.

3 See 10 C.F.R. §50, Appendix I; Division of Risk Analysis, Office of Nuclear Regulatory Research, Nuclear Regulatory Commission, A Handbook for Value-Impact Assessment 3.15 (1983).

4 Spangler, Trans-Scientific Issues in Risk-Cost-Benefit Analysis of Energy Options 13 (unpublished manuscript 1985). An earlier NRC report translated the person-rem standard into a wider range of $4 million to $100 million depending on assumptions made. See NUREG - CR2899, Analysis of a Proposed $1000 Per Man Rem Cost Effectiveness Criterion (1982).

5 See Office of Management and Budget, Regulatory Program of the United States Government, 1987-1988 xx (hereinafter "OMB").

and Drug Administration banning DES in cattle feed). Were decisions to regulate based on a strict comparison of costs and benefits, adoption of the CPSC regulation would imply that the agency valued life at a figure *no less* than $70,000 while rejection of the FDA regulation would imply a valuation of *no greater* than $131,999,999. In another investigation of rulemakings concerning environmental carcinogens at four agencies -- Environmental Protection Agency, Consumer Product Safety Commission, Occupational Safety and Health Administration, and Food and Drug Administration -- researchers found that, at least in this important class of health regulation, we as a society tend to regulate vigorously if lives can be protected at less than $2 million per life saved, but not if costs are significantly higher.[6]

Standing alone, variation in implicit or explicit values is not necessarily troublesome. As we discuss later in this report, different circumstances may justify the use of different valuations of lives. More problematic, however, is a divergence among agencies in the effort expended to derive a meaningful calculus of factors to be used in determining whether regulatory costs are justified, given the resulting savings of lives. Although some agencies -- notably EPA[7] and the Federal Highway Administration[8] -- have commissioned extensive studies that seek to draw on and expand existing knowledge about life valuation, our research reveals less intense documentation efforts at the vast majority of agencies. Some agencies appear willing to accept a figure, notwithstanding the absence of independent evaluation of its veracity or its application to the borrowing agency's regulatory task.[9]

Given the range of figures and methodologies employed in the valuation of human life, there is justifiable concern that selections are based on the regulator's predisposition about a proposal's desirability rather than on the merits. Certainly valuations can be set purposefully as one of several criteria guiding decision makers. For instance, Viscusi, in surveying available normative studies of life valuation, found that (depending on the particular circumstances) plausible justifications are available for values from $600,000 (where individuals place themselves voluntarily in high risk situations) to $7 million (where risks are involuntary and remote).[10] Recent reviews of valuation studies support a range of $1.6 to $8.5 million.[11] But, of course, value of life outcomes also may be a by-product of decision making that is guided by other considerations entirely. Indeed, as we shall see,

---

6 Travis et al., Cancer Risk Management: A Review of 132 Federal Regulatory Decisions, 21 Environmental Science and Technology (1987).

7 See EPA, Valuing Reductions in Risks: A Review of the Empirical Estimates -- Summary (1983).

8 See Federal Highway Administration, Alternative Approaches to Accident Cost Concepts -- State of the Art (1984).

9 In hearings concerning EPA's asbestos regulations, Jack Campbell, Deputy Assistant Administrator for Policy, Planning, and Evaluation at EPA, stated: "The $1 million per life saved figure is in essence an arbitrary figure in any (regulatory) analysis, and it is used basically as a baseline to judge whether there are positive or negative net benefits to society as a result of a particular action." EPA's Asbestos Regulations, Hearings Before the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, 99th Cong., 1st Sess., April 16, 1985, at 455.

10 See Viscusi, The Valuation of Risks to Life and Health: Guidelines for Policy Analysis 201-02 n.5, in J. Bentkover et al., Benefits Assessment: The State of the Art (1986).

11 Fisher, Chestnut, & Violette, The Value of Reducing Risks of Death: A Note on New Evidence (forthcoming).

some argue that such numbers are largely devoid of meaning and, in any event, repugnant or irrelevant.

Why life saving values differ across types of rulemakings and agencies, whether they should vary, and the propriety of the manner in which agencies derive and utilize them comprise the focus of this report. We begin in Section II with a discussion of the Executive Orders and statutory and case law that define the parameters for agency valuation practices. Section III then turns to a broad array of issues that arise in the valuation process, including philosophical reservations about any explicit valuation efforts and more pragmatic questions concerning valuation techniques. Finally, Section IV provides our concluding observations and recommendations for improvements in agency practice.

One final caveat is necessary before we proceed to the substance of this study. Our inquiry is to determine how human life is and ought to be valued on those occasions when federal agencies determine such calculations to be desirable. We are not here concerned with defining the circumstances under which consideration of the value of human life should be an integral part of agency decision making. As we indicate in the next section, that determination requires analysis of applicable case law, statutes, and executive orders. Our recommendations speak only to those situations in which an agency has determined, based on one of these independent mandates, that the value of human life is a necessary or useful variable in a policy decision. Additionally, we are not here concerned with the propriety of particular modes of analysis in which the value of human life may be a factor. Specifically, we do not seek to re-enter the continuing debate over the use of a strict cost-benefit analysis with respect health and safety regulation. We seek instead to recognize that under several modes of analysis it may be helpful to assign some value to human life. For instance, even if one rejects the proposition that environmental decision making should be predicated exclusively on a comparison of monetized costs and benefits, attention to monetized values may be useful to determine whether conclusions reached on the basis of other variables deviate significantly or only minutely from conclusions that would be reached through a cost-benefit calculation. Nevertheless, we recognize that, for some, any discussion of monetized values for human life conjures images of mechanistic or amoral decision making. Thus, we wish to indicate strongly at the outset that our attention to the question of valuation does not necessarily entail endorsement of any particular procedure for ultimate determinations of the desirability of regulation. We do believe that valuation of life provides data that can be considered in any such determination. It is for the political process to ascertain the variables ultimately considered in any decision concerning regulation. The credibility of any such conclusion, however, depends on the reliability and availability of the underlying information. For that reason, it is essential that the methods used for valuation of human life be as complete and open as possible. It is with that end in view that we proceed.

II. Legal Bases for Agency Valuation of Human Lives.

Administrative agencies that possess statutory authority to promulgate health and safety regulations face a variety of constraints on what and how they may regulate. The most obvious and direct of these are contained in certain generic laws such as the Administrative Procedure Act[12] and in each agency's organic statute. While the generic laws are silent on life valuation matters, a number of specific statutes limit and guide agencies in ways that affect any attempt to value human life, as discussed in Section II.B. We also examine in that section an additional array of life valuation constraints appearing in judicial decisions. First, however, we review in Section II.A the tier of requirements that

---

12 5 U.S.C. §§ 551-59, 701-06, 3105, 3344, 5362, 7521.

has emanated from the executive branch and been superimposed on the more traditional statutory and judicial constraints.

A. Overview of Executive Orders Mandating Cost/Benefit Analysis and Associated OMB Guidance

Most statutes allow agencies considerable discretion in the design and implementation of new regulations. Such agency discretion is substantially narrower where the Congress specifically designates the regulatory action to be taken by an agency, but congressional intervention in the minutiae of implementation is uncommon. In the main, Congress provides fully detailed mandates only where it lacks confidence in prior (as with NHTSA's auto ignition/seat belt interlock regulation) or expected (as with deadlines imposed to accelerate some EPA regulation) agency conduct. Even then, however, agencies are left with responsibility for a host of practical decisions that usually prove necessary to translate a statutory design into an implemented regulation. Thus, managing the regulatory process requires much agency judgment, often extending to basic decision criteria and priorities in addition to the unavoidable details of implementation.

When Congress delegates to an administrative agency the duty to regulate a health or safety problem, it typically is expressing its intent that the agency's specialized expertise guide regulatory action.[13] The Congress, that is, looks to the head of the designated agency, and not to the President, for the solution to a problem. This creates a natural tension, or at least an added decision complexity, for those agencies that are subject to White House supervision (i.e., those agencies whose heads serve at the pleasure of the President). For inherent in the executive function of the Presidency is the obligation to ensure the faithful execution of the law, which unavoidably entails responsibility for agency exercise of discretion.[14]

Recent administrations have taken progressively increased cognizance of this authority and have used it to structure regulation in a manner consistent with broad political objectives. A White House managerial process has evolved to guide agency use of whatever discretion exists in the regulatory statutes. The Reagan Administration in particular has made vigorous use of the Executive order mechanism and of the 1980 Paperwork Reduction Act in managing the issuance of regulations. It has articulated a distinctive set of regulatory principles and established a more potent central oversight process than existed previously.

The current process grew out of several years of experimentation with shifting White House review mechanisms.[15] The most noteworthy antecedent prior to 1974 was the "Quality of Life Review" process started in 1971 by the Office of Management and

---

13 See DeMuth & Ginsburg, White House Review of Agency Rulemaking, 99 Harv. L. Rev. 1075, 1077-79 (1986) (arguing that deference to agencies furthers the objective of efficient rulemaking).

14 See, e.g., Sierra Club v. Costle, 657 F.2d 298, 405-07 (D.C. Cir. 1981).

15 The following discussion of the 1975-81 period is drawn from Hopkins, Social Policy and the Regulatory Process: A 1986 Working Paper of the Project on the Federal Social Role. See also, Baram, Cost-Benefit Analysis: An Inadequate Basis for Health, Safety, and Environmental Regulatory Decisionmaking, 8 Ecol. L. Q. 473, 502-15 (1980); OMB, supra note 5.

Budget.[16] Motivated principally by concern about rising budgetary and industrial compliance costs of new environmental regulations, OMB Director George Shultz signed memoranda directing agencies to submit significant regulatory proposals to OMB for review. In practice, this review process focused on proposals from only one agency, the Environmental Protection Agency. The process involved interagency meetings, convened by OMB, at which EPA defended its intended actions in a hostile forum dominated by staff from OMB and the Department of Commerce. This mechanism had narrow scope and dubious authority, but it continued to operate until 1977, when EPA declared that it would no longer participate.

Starting well before 1977, however, the Quality of Life Review process came to be superseded gradually by oversight mechanisms with stronger legal footholds. In 1974, President Ford signed the first of what has turned out to be a very significant series of Executive Orders on the regulatory process. As it came to be implemented, his 1974 Executive Order 11821 required that those agencies whose heads serve at the pleasure of the President prepare an Inflation Impact Statement ("IIS") for every new regulation likely to have a substantial economic effect. Although the Office of Management and Budget approved several different criteria for agencies to use in deciding which regulations would have large enough effects to warrant an IIS, the standard most heavily relied on involved aggregate compliance costs imposed on those regulated in excess of $100 million in any single year.

The IIS was to include a full appraisal of the benefits and costs of the rule relative to those of promising alternatives, but the agency did not have to base its decisions about design or issuance of the rule on the IIS, or even use it in the decision process. An inadequate (or non-existent) IIS posed no direct legal problems, and afforded private parties no new grounds for litigation. The courts saw it as an internal managerial tool clearly within the discretion of the President to apply as he saw fit.[17]

Essentially the IIS analysis provided contending interests added targets or support and served as a key resource for White House overseers. During its seven-year existence (1974-81), the Council on Wage and Price Stability ("CWPS"), which served as the principal regulatory monitoring unit within the Executive Office, used the IIS to shift the regulatory debate toward efficiency concerns. (The initial labels did not suggest this emphasis; indeed, both the IIS and the creation of the CWPS had reflected renewed worry about inflation.) With no powers to coerce, the CWPS' influence derived from its access to agency decision makers and its broad statutory authority[18] to issue public statements on pending rulemaking proceedings.

The efficiency perspective advocated by CWPS gradually came to be accepted as legitimate and potentially powerful. During the Ford Administration, CWPS prepared and publicized policy papers sharply critical of many regulatory proposals. This stimulated greater public debate and increasingly put regulators on the defensive. In response, some regulators began to take the IIS requirements much more seriously, seeking to explain more explicitly the economic effects of their proposals. Near the end of the Ford Administration, Executive Order 11949 changed the IIS label to Economic Impact Statement to reflect its true focus.

---

16 See Eads & Fix, Relief or Reform? 46-50 (1980); National Academy of Public Administration, Presidential Management of Rulemaking in Regulatory Agencies 9 (1987).

17 See, e.g., Meat Packers Assn. v. Butz, 526 F.2d 228, 234-36 (8th Cir. 1975), cert. denied 424 U.S. 966 (1976).

18 See P.L. 93-387, §3(a)(7).

The incoming Carter Administration, after more than a year of debate about the CWPS program, decided to continue the CWPS with basically the same role on regulatory matters, and to create a new player, the Regulatory Analysis Review Group ("RARG"). Chaired by the Council of Economic Advisers, the RARG provided a forum for executive branch agencies to discuss the economic analysis of 10 to 20 key regulatory proposals each year. While many agencies were RARG members, it was dominated by staff drawn from units of the Executive Office of the President who were skeptical of traditional regulation.

A new Executive Order (12044) was issued in 1978, replacing President Ford's Executive Order 11949. The analysis required for major new regulations under this order was renamed Regulatory Analysis ("RA") and slightly recast. Each RA was to contain

> a succinct statement of the problem; a description of the major alternative ways of dealing with the problem that were considered by the agency; an analysis of the economic consequences of each of these alternatives and a detailed explanation of the reasons for choosing one alternative over the others.[19]

The Executive Order also added a number of features to regulatory oversight, including a semiannual agenda alerting the public to all nontrivial rules under development, and tighter management of the major rule analysis process. RA's were to be issued in draft form at the rule proposal stage and in final form when the rule was promulgated.

Noteworthy by its absence from the Carter Executive Order was any reference to "benefit cost analysis," which Administration officials thought many perceived as unbalanced and anti-regulatory, in that the less readily quantifiable social benefits would be slighted by cost-benefit analysts. Yet the distinction between that mode of analysis and the "analysis of the economic consequences of . . . alternatives" required for an RA is largely one of semantics and emotions.

The Ford Executive Order had called for cost-benefit analysis to be performed but was silent on how if at all that analysis would be used in actual decisionmaking. The Carter Executive Order moved toward requiring some use of analysis in making decisions, however cautiously: each agency was to select, in any manner it wished, alternative actions it found acceptable; it then was directed to adopt the least burdensome of these alternatives.

Under the leadership of CEA and, to some extent, OMB, the Carter program featured extensive consultation among agencies intended to reach consensus on the analysis and shaping of key regulatory proposals. However, OMB drew narrow limits around its role in this process: "...for OMB to approve or provide appellate review of the substance of individual regulations would be inappropriate and counter to the emphasis on agency accountability in the Executive Order."[20] The consultations held under RARG auspices produced, for each of the small number of regulatory proposals reviewed, a public report that, as a consensus document, was perhaps less strident than many CWPS reports of the Ford period. But in any event such reports continued to be merely advisory.

Within weeks of President Reagan's inauguration, Executive Order 12291[21] made cost-benefit analysis a key determinant of agency decisions, and assigned pre-clearance responsibilities to OMB -- in both cases, to the extent permitted by law. Major regulations

---

19 Executive Order 12044, §3(b)(1).

20 43 Fed. Reg. 126691.

21 Reprinted in 5 U.S.C. §601 (Supp. 1988).

continued to face an economic analysis requirement, now renamed Regulatory Impact Analysis (RIA). OMB assumed expanded oversight duties that had previously been shared by CWPS and RARG, both of which were eliminated in 1981.

The Reagan regulatory principles declare that, to the extent permissible under law, regulation should satisfy two primary criteria. First, regulation would be utilized only where it would resolve a problem more effectively than would market forces. Second, regulation was to be structured to maximize net benefits to society. This position, articulated initially in Executive Order 12291, has been amplified in subsequent White House documents,[22] including most notably in the Regulatory Program of the United States Government, April 1, 1987-March 31, 1988. On the theory that one can only determine whether net benefits are maximized through the use of cost-benefit analysis, the Reagan regulatory principles constitute an endorsement of that particular analytical tool.[23]

This Presidential requirement for the use of cost-benefit analysis in regulatory decisionmaking, except where precluded by statute, necessarily carries with it an understanding that those lives at stake in regulatory outcomes will be evaluated in some fashion. Otherwise, any calculation of a regulation's net benefits will exclude what often is its most fundamental objective -- lessening the risk of fatalities. An estimate of the net benefits of a health or safety regulation that takes into account factors such as property damage averted, medical costs avoided, and compliance burden imposed certainly will be misleading and incomplete unless it also includes some valuation of fatalities prevented or of life-years extended.

The Executive Order and related documentation recognize that not all effects of a regulation can be translated into a dollar metric, but they do establish a presumption that much can be accomplished in presenting more comprehensive dollar measurements of both benefits and costs. The concept of net social benefits found in the Reagan regulatory principles is a broad one. It includes any consequence of a regulation that alters the level of material affluence or welfare. Some such consequences are difficult or impossible to measure unambiguously -- e.g., the climate for innovation -- while others can be measured by physical attributes that are difficult at best to convert into dollar terms -- e.g., miles of cleaner waterways. The message conveyed by the Reagan principles is that agencies should attempt to go further than they did previously in quantifying all such effects, whether benefits or costs, and in expressing these effects in dollar terms. The contention is that such explicitness will facilitate arriving at optimal policy decisions.

Once an agency has pushed quantification and monetization of regulatory effects as far as is practicable, the Reagan principles require presentation of its conclusions about net benefits in a way that will not slight those effects that cannot be monetized. There of course always is a temptation for the reader of a partly quantitative and partly narrative analysis to be overly swayed by the former. Nonetheless, the current Administration's principles do not on their face condone disregard of qualitative effects.

As to human life, two obvious questions arise in connection with current regulatory principles. When a regulatory initiative is being contemplated to lessen a health or safety hazard, with what confidence can the agency estimate the number and time pattern of fatalities avoided or deferred? And what, if any, monetary value can be placed on this reduction in fatality risk? The former question is left entirely to the regulatory agency to address; the White House merely encourages the agency to go as far as it prudently can in

---

22 See, e.g., Executive Order 12498, reprinted in 5 U.S.C. §601 (Supp. 1988).

23 See, DeMuth & Ginsburg, supra note 13.

making such estimates. The latter also is largely -- but not entirely -- delegated to the individual agencies.

As the chief player in the Presidential regulatory oversight process, OMB does not endorse any particular number as a suitable statistical value of life for agency cost-benefit analyses. And other White House participants, most notably the Vice President in his capacity as chair of the Presidential Task Force on Regulatory Relief, have distanced themselves from placing any numerical value on human life. There are large political problems -- to say nothing of the philosophical and economic issues -- associated with appearing to assert that a human life can be reduced to a particular dollar value. Explanations that the value is established for analytical purposes and is for a statistical life (or for a measurable though small reduction in the risk of fatality) are insufficiently saleable to avert political damage.

Nonetheless, OMB has an important influence on how agencies do value life in their Regulatory Impact Analyses (the formal analysis that the Executive Order requires for every major regulatory initiative). That influence derives in part from generic guidance offered agencies by OMB on a hortatory basis and in part from the OMB regulatory clearance process. As to generic guidance, the opening sections of the Regulatory Program issued by the White House in the spring of 1987 contain considerable discussion of what OMB views to be the soundest methodology for selecting statistical values of life, as well as evaluative commentary on the range of life values implicit in several agencies' regulatory decisions. That preferred methodology, discussed more fully in Section III.B of this report, is usually termed willingness-to-pay, and is based typically on labor market studies of wage variation across jobs that present differing levels of risk. While this procedure has not led OMB to endorse a particular value for human life, our interviews with staff of that agency indicate they they would generally accept regulations that cost out to less than $2 million per life, but would look askance at regulations that required expenditures much in excess of that figure.

The regulatory clearance process is also an important avenue through which OMB influences agency valuation decisions. Under the 1981 Executive Order, virtually every regulatory proposal (from any agency subject to Executive Order jurisdiction) must be reviewed by OMB at two (or more) junctures before it takes effect. Moreover, Executive Order 12498, issued in 1985, provides that, for all important contemplated regulations, agencies are to consult with OMB prior to beginning work on their design, and out of that consultative process emerges an annual publication of Administration-endorsed regulations under development.

Before an agency publishes a covered regulation in proposed form to obtain public comment (even those too minor to warrant inclusion in the Regulatory Program), it must secure OMB review. At this point, OMB is in a position to object to any aspect of the draft proposal, including whatever value of life the agency may be utilizing in its analysis supporting the proposal. On occasion, disagreement over this value reportedly has been sharp and has led to delay. Under certain circumstances, OMB can block an agency from proceeding until it satisfies OMB that the proposal is consistent with the President's regulatory principles. Finally, before an agency can publish any regulation in final form, it must again go to OMB for a further review round. Thus OMB has ample opportunity -- both on and off the record -- to communicate its views to the regulatory agency on the suitability of any particular value of life.

Not all health and safety regulation encounters this manner of OMB review, because not all regulatory agencies are obliged to conform to Executive Order requirements. Traditionally, the "independent" agencies, whose heads are not subject to Presidential

removal, have regarded themselves as exempt from the kind of OMB review discussed above. OMB has a negligible influence on such agencies' practices in valuing life, although some have adopted analytical approaches quite consistent with the basic Executive Order (e.g., the Nuclear Regulatory Commission's internal requirements for economic analysis correspond quite closely with that established by OMB).

Nonetheless, there is one important respect in which OMB does influence regulation at independent agencies. Under the Paperwork Reduction Act of 1980, no agency (independent or otherwise) can enforce a new regulation containing paperwork requirements (information collection elements) until it has obtained OMB concurrence. It is possible but not likely that issues touching on life valuation have important bearing on this OMB/agency interaction, which turns mainly on questions of the reasonableness of the time necessary to supply the information mandated.

B. Constraints of Statutory and Case Law

The executive branch's endorsement of cost-benefit analysis has not achieved universal acceptance within the legislative and judicial branches. Nevertheless, these branches must often wrestle with the issue of whether a particular regulatory effort is appropriate or authorized. Even if these inquiries are not answered by reference to a strict cost-benefit analysis, some consideration of the relevant adverse and positive effects of the proposed regulation would appear necessary for a rational decision. For instance, assume that we must choose between two methods of implementing a program (e.g., a program of vaccination against an anticipated epidemic), each of which would save the same number of lives, but each of which would also produce some new level of risk. The first would present a low level risk (e.g., short term, non-fatal disease due to vaccination) to numerous persons. The second would produce a high level risk (death) to a very small number of persons (e.g., those with severe abreactions) and produce no adverse reactions for anyone else. Can it be said to be illogical or unethical to consider expected losses of each policy in trying to determine which one is superior? Any such process, however, at least implicitly places a value on the lives saved or expended in the decision whether or how to regulate.

The need for agencies generally to balance the positive and negative effects of a proposed regulation -- and hence to evaluate the worth of human life -- is apparent from an examination of the statutes that authorize agency intervention. Most of these statutes confer on administrators some discretion in determining whether to promulgate a particular regulation, but constrain that discretion by reference to regulatory effects on human welfare. These constraints, however, typically are not expressed in terms of an explicit cost-benefit analysis.

In rare cases congressional standards for regulatory action are sufficiently specific that an agency need only determine whether the congressional judgment has been satisfied. Thus, a statute that requires specific agency action when a calculable threshold is passed does not confer on the agency any discretion to determine whether that particular standard is reasonable, necessary, or useful. The agency need strike no balance in which human life would be a necessary factor. Similarly, if congressional judgment required regulation as long as any threat to human life existed, computation of human life values would be unnecessary. Any threat to life would be considered too substantial, so the monetized value of benefits preserved through regulation would be irrelevant. The most celebrated instance of such a provision may be found in the Delaney Clause of the Federal Food, Drug, and Cosmetic Act.[24] The Clause prohibits the use as a food additive, animal drug,

---

[24] 21 U.S.C. §§301 - 92.

or color additive of any substance found to induce cancer in humans or animals.[25] No threshold finding is required; when it comes to cancer, the specified additives and drugs are expected to produce zero risk.

Alternatively, statutes may go so far as to require explicitly that costs and benefits of proposed agency action be compared before any regulation proceeds.[26] These provisions indicate congressional realization that achieving zero risk is infeasible; at some point the costs of further risk reduction will not be worth the attendant benefits. Thus, regulation depends on some comparison of the two. Since much regulation returns substantial benefits to human welfare in the form of lessened mortality and morbidity rates, a meaningful determination of relative costs and benefits requires that some value be assigned to these welfare effects so that they properly can be incorporated into the calculus.

More frequently, however, congressionally granted authority confers on agencies substantial discretion in the decision to regulate. This discretion may be bounded by standards such as "reasonableness" that permit, but do not expressly require the agency to engage in some sort of comparison of costs and benefits of a proposed regulation in determining its effects on human welfare. For instance, the Federal Insecticide, Fungicide, & Rodenticide Act (FIFRA)[27] permits the Administrator of the Environmental Protection Agency to take protective action with respect to a pesticide that causes "unreasonable adverse effects" on the environment.[28] Similarly, the Atomic Energy Act[29] requires the Nuclear Regulatory Commission to ensure that production of nuclear material will provide "adequate protection" to the health and safety of the public;[30] and the Federal Highway Administration is empowered to publish "reasonable rules" for the safe operation of motor carriers, e.g., driver qualifications, maximum hours, and equipment standards.[31] The Motor Vehicle Safety Act[32] requires that motor vehicle safety standards be "practicable, "[33]

---

25 21 U.S.C. §§348(c)(3)(a), 360b(d)(1)(H), 37b(b)(5)(B). Richard Merrill suggests that the Delaney Clause is less inclusive or absolute than the debate surrounding its propriety would suggest. See Merrill, Risk-Benefit Decisionmaking by the Food and Drug Administration, 45 Geo. Wash. L. Rev. 994, 998 (1977). On the difficulty of administering such a specific standard, see Merrill, FDA's Implementation of the Delaney Clause: Repudiation of Congressional Choice or Reasoned Adaptation to Scientific Progress?, 5 Yale J. Reg. 1 (1988).

26 See, e.g., Consumer Product Safety Act § 9(f), 15 U.S.C. §2058(f); Federal Hazardous Substances Labeling Act §3, 15 U.S.C. § 1262(i). The Clean Air Act, 42 U.S.C. §§7401- 7642, requires a benefit-cost analysis for any regulation intended to control the effectiveness of motor vehicle fuel emission control systems. See 42 U.S.C. §7545(c)(2)(B).

27 7 U.S.C. §§136 - 136y.

28 7 U.S.C. §136d(b).

29 42 U.S.C. §§2011-2296.

30 42 U.S.C. §2232(a). This provision has been construed in Union of Concerned Scientists v. Nuclear Regulatory Commission, 824 F.2d 108 (D.C. Cir. 1987), discussed at text accompanying notes 57 - 61 infra.

31 49 U.S.C. §§304(a), (e).

32 15 U.S.C. §§1391-1431.

33 15 U.S.C. §1392.

a term that the Department of Transportation suggests requires consideration of both technological and economic soundness.[34]

Most of the statutes that are administered by the EPA similarly invite, but do not compel, attention to some of the elements of a cost-benefit analysis.[35] For instance, the agency interprets the statutory directive concerning primary National Ambient Air Quality Standards[36] to permit attention only to public health, and thus EPA sets these standards without consideration of analyses that evaluate costs or nonhealth benefits.[37] The agency, however, interprets the statutory mandate concerning establishment of performance standards for new stationary sources of pollution as requiring consideration of costs, but not air quality benefits. Thus, EPA sets the relevant standards after consideration of costs, cost-effectiveness, and economic impacts and not air-quality-related benefits.[38] Alternatively, EPA believes that it is permitted to consider all aspects of cost-benefit analysis in determining standards under the Uranium Mill Tailings Radiation Control Act, an amendment to the Atomic Energy Act. That broad-ranging amendment requires EPA to "consider the risk to the public health, safety, and the environment, the environmental and economic costs of applying such standards and such other factors as the Administrator determines to be appropriate."[39]

Judicial solicitude for strict agency cost-benefit analysis in the absence of an explicit legislative requirement was tested in a duet of Supreme Court cases, Industrial Union Department v. American Petroleum Institute[40] (the Benzene Case), and American Textile Mfrs., Inc. v. Donovan (the Cotton Dust Case).[41] In each case, the Court was considering whether standards promulgated by the Occupational Safety and Health Administration (OSHA) satisfied the statutory obligation of that agency to assure "to the extent feasible" that no employee would suffer material impairment of health or functional capacity.[42]

In the Benzene case, the Court considered whether a statutory directive that OSHA standards assure, as far as possible, that employees not be impaired by exposure to hazards precluded any cost-benefit analysis in the formulation of regulations. The agency had determined that, in the case of exposure to the carcinogen benzene, this directive required the most stringent limitation that was technologically and economically possible. Thus, cost-benefit analysis was unnecessary, if not outright prohibited. The Supreme Court, however, affirmed a determination by the Fifth Court of Appeals that some relationship between costs and benefits had to be made. While no opinion garnered a majority of the high court, a plurality did determine that the issue of how protective a standard should be

---

34 Letter of April 2, 1979, from Linda Heller Kamm, Department of Transporation, Office of General Counsel, to Ron Lewis.

35 See Environmental Protection Agency, EPA's Use of Benefit-Cost Analysis: 1981-1986 at 3-1 - 3-7 (August 1987).

36 Clean Air Act §109(b)(1).

37 EPA, supra note 7, at 3-3.

38 Id.

39 Public Law 97-415, January 4, 1983. See EPA, supra note 7, at 3-7. EPA may consider all aspects of cost-benefit analysis under the similarly broad language of the Toxic Substances Control Act, 15 U.S.C. §§2601-2629, which permits consideration of health and environmental effects as well as economic consequences.

40 448 U.S. 607 (1980).

41 452 U.S. 490 (1981).

42 29 U.S.C. §655(b).

imposed had to await a threshold determination of whether there existed a significant risk of material health impairment.

Though there were hints in the plurality and concurring opinions that cost-benefit analysis was congressionally mandated, and explicit statements in the dissent that reliance on cost-benefit was unauthorized, no final determination of the issue was made until the Cotton Dust Case. There the Court focused on the "feasibility" language of the statute and decided that that requirement displaced the obligation to undertake a cost-benefit analysis of a proposed regulation. Instead, a different, and presumably less rigorous, "feasibility" analysis was required. The function of the latter procedure was to determine that implementation of a proposed standard is "capable of being done."[43]

This semantic exercise, unfortunately, does little to displace the need for some comparative consideration of the costs and benefits of a proposed regulation. Numerous safety standards can be implemented at some cost, and are thus "capable of being done" within the narrow meaning of the Supreme Court's mandate. Less certain is whether the benefits obtained by implementing any standard are worth the associated costs. Unless the congressional directive is to take all precautions that are technologically possible, the absence of some standard by which to determine whether marginal advances in safety are worthwhile is likely to generate either overinvestment or underinvestment in accident avoidance from a societal perspective.

Our point at present, therefore, is to suggest that the obligation to consider values for human life is not only implicated where an agency is required specifically to compare costs and benefits. Statutory provisions may require particular attention to specific regulatory effects rather than a strict analysis that sanctions only those regulations whose benefits exceed costs. The FIFRA provision referred to above, for instance, requires the Administrator to take into account the impact of proposed final action on production and price of agricultural commodities, retail food prices, and the agricultural economy.[44] Similarly, where noncarcinogens are concerned, the Food and Drug Administration is required to determine whether food additives are "safe" for their intended use, a standard that does not necessarily implicate a finding of benefits in excess of costs or require banning additives whose costs exceed marginal benefits.[45]

Indeed, concerns for factors that might escape a naked comparison of costs and benefits have generated statutes that mandate reliance on less quantitative variables. For instance, the Federal Mine Safety and Health Amendments Act,[46] albeit less explicit than its predecessors,[47] demonstrated concern for the safety of miners by requiring closure of mines notwithstanding that the consequent costs might exceed expected losses to miners. Nor do these nonquantitative concerns consistently demonstrate solicitude for safety. Richard Merrill recounts congressional intervention to delay FDA programs designed to reduce the risk of adverse health effects related to shellfish, presumably to satisfy industry concerns.[48] While these programs may require that certain factors on either the cost or benefit side of the calculus be ignored, insofar as they eschew any absolute benchmark by

---

43 452 U.S. at 509.

44 7 U.S.C. §136d(b).

45 21 U.S.C. §348(c)(3)-(4). See Merrill, supra note 25, at 999.

46 30 U.S.C. §§801-78.

47 See Neely, Statutory Inhibitions to the Application of Principles of Cost/Benefit Analysis in Administrative Decision Making, 23 Duq. L. Rev. 489 (1985).

48 See Merrill, supra note 25, at 1000.

which to determine the propriety of a particular regulation they require some synthesis of costs and benefits. Effective implementation of that mandate, therefore, requires some valuation of human costs saved or lost by the decision to regulate.

Even the emerging judicial antipathy towards cost-benefit analysis does not preclude regulation predicated on some rational basis that includes human life valuations. This is most evident in recent decisions of the District of Columbia Court of Appeals that reflect inconsistent constructions of congressional grants of regulatory authority that affect human welfare.

In Natural Resources Defense Council v. EPA,[49] the District of Columbia Court of Appeals heard an appeal concerning standards for the emission of vinyl chloride promulgated by the Administrator of the EPA. Vinyl chlorides are carcinogens with no known threshold and a twenty-year latency period. Given the uncertainty of the hazards of a particular emissions level, the Administrator had required that emissions be reduced to the lowest level attainable by the best available control technology. The petitioner contended that the statutory basis for regulation, section 112 of the Clean Air Act,[50] precluded consideration of cost or technological feasibility. Instead, the petitioner argued, that provision, which requires emission standards be set at a level that creates "an ample margin of safety to protect the public health, "permitted consideration only of health-related factors. Thus, in the face of uncertainty, the Administrator was constrained to require a zero-emissions level.

In a decision by Judge Bork, a three-judge panel of the court upheld the authority of the Administrator to withdraw proposed regulations of vinyl chlorides by relying solely on economic and technological factors.[51] Congressional delegation of discretionary authority to the Administrator, in Bork's view, permitted the delegate to select the factors that would guide the exercise of that discretion. In a subsequent en banc decision also authored by Judge Bork, however, the court created a standard for "ample margin of safety" that precluded a strict cost-benefit analysis. The court adhered to the view that safety did not require zero-risk and thus dismissed the NRDC position. But it found that the Administrator could not simply define the appropriate margin of safety by reference to what was cost-effective; the Administrator was constrained by the primacy that Congress intended be given to health effects.[52] The court characterized the EPA's position as permitting a standard that would prohibit emissions to a point where marginal costs of additional controls exceeded marginal reductions in risk to health. Thus, definitions of "safety" were not made by reference to the Administrator's expertise, scientific risk assessments, or risks to health at particular emission levels, but only to a naked comparison of "technological and cost feasibility." The court rejected any such approach.[53] While the court was willing to permit consideration of these cost and technological factors, and specifically rejected the view that a "safe" level of emissions was one that was "risk-free," the court did mandate an initial, independent judgment of safety predicated on risks to health at particular emission levels.[54] Determinations of risks to health could be based on both scientific data and non-quantifiable factors such as risks deemed "acceptable in the

---

49 824 F. 2d 1146 (D.C. Cir. 1987)(en banc).
50 42 U.S.C. §7412(b)(1)(b).
51 804 F.2d 710 (D.C. Cir. 1987).
52 824 F.2d at 1163.
53 824 F.2d at 1164.
54 824 F.2d at 1164.

world in which we live."[55] The "risk to health" decision, however, could not consider cost and technological feasibility. Nevertheless, once the safety threshold had been crossed, the Administrator could address remaining uncertainties by considering those economic factors in determinations of an "ample margin" of safety.[56]

The ability to engage in an explicit cost-benefit analysis became more doubtful under the approach taken most recently by the court in Union of Concerned Scientists v. Nuclear Regulatory Commission.[57] That case concerned the authority of the Nuclear Regulatory Commission to consider economic costs when deciding whether to require safety-enhancing modifications for previously licensed nuclear power plants. The Commission had proposed a rule that would require so-called "backfits" only when their direct and indirect costs were justified by a substantial increase in protection to health and safety.[58] Rather than accept or reject economic costs as the talisman for nuclear regulation, the court attempted a Solomonic compromise: economic costs could not be considered in determining whether regulation was necessary to satisfy the statutory mandate that the Commission provide "adequate protection" to public health and safety.[59] The Commission, however, could consider economic costs, "even to the extent of conducting strict cost-benefit analysis"[60] in establishing safety requirements beyond those necessary to meet the adequate safety requirements. Since the court understood that this interpretation meant that adequate protection was not synonymous with risk-free or absolute protection, the Commission presumably must engage in some sort of analysis of whether costs of regulation are worth incurring in order to render the level of safety "adequate." While the District of Columbia Circuit indicated that strict cost-benefit analysis is not appropriate to the task, and, indeed, has prohibited consideration of costs in the establishment of the adequate protection standard,[61] it seems logically impossible for the Commission to derive a standard of adequacy without paying some attention to the relative costs and benefits of a proposed regulation. To the extent that even"adequate protection" leaves some lives exposed, any meaningful decision concerning the desirability of a proposed regulation must implicitly, if not explicitly, value those lives relative to the cost of the proposal.

These recent cases suggest that application of cost-benefit analysis and the need for valuation of life to test the propriety of a regulatory effort are not coterminous. Even where courts have rejected the propriety of the former, they have not compelled regulations that create a "risk-free" society. The result is the need for regulations that provide "reasonable," "ample," or "adequate" levels of safety. Yet such phrases cannot be defined or applied without some reference to the relative effects of alternative policies. In a situation where human lives are put at risk, any such reference compels agencies to decide whether proposed standards will save sufficient lives to justify the associated expenditure. That justification may be predicated on considerations additional to technological or cost feasibility. But at some point, presumably most individuals in society would cease investing in safety. It is the derivation of that point that ultimately drives the quest for some valuation of life.

---

55 824 F.2d at 1165.

56 824 F.2d at 1165 ("Once 'safety' is assured, the Administrator should be free to diminish as much of the statistically determined risk as possible by setting the standard at the lowest feasible level.").

57 824 F.2d 108 (D.C. Cir. 1987).

58 10 C.F.R. 50.109(a)(3) (1986).

59 42 U.S.C. §2232(a).

60 824 F.2d at 114.

61 Id. at 119.

* This sounds very much like Vinyl Chloride.

III. Issues in the Valuation of Human Life

A. Introduction

As we noted at the outset, our purpose in this report is to examine the processes through which government, implicitly or explicitly, values human life for purposes of regulation. Stating our purpose in this way, however, necessarily accepts the propriety of the effort at valuation and seeks only to refine it. Such a strategy threatens to ignore an important and cogent response to the entire effort at valuation, i.e., that any attempt to quantify the value of human life is inherently inappropriate, not because of the difficulty of the task or the intangibility of various factors that must be considered, but because the very process of quantification ignores and violates the sanctity of human life.

In its broadest formulation, the opposition to quantifying human life is based on the assertion that human life has a "sacred" value that cannot be reflected in monetized or quantified terms.[62] Douglas MacLean, a primary proponent of this view, means by this phrase that we adhere to certain ritualistic beliefs and practices in a manner that expresses "the special value of human life in our culture."[63] By so doing, we signal the community that saving lives has merit that exceeds even a precisely computed value. Any attempt to quantify human value is inconsistent with the symbols and rituals that we use to signal life's special meaning within the society.

Alternatively, commentators suggest that the very process of attempting to quantify the value of human life diminishes that value by suggesting that human life is exchangeable in a manner akin to commodities. Regardless of our ability to consider a commodity as a substitute for human life (one can, after all, compare apples and oranges), some suggest that there may be reasons not to admit our lack of uniqueness.[64] We may, for instance, wish to signal to ourselves the intrinsic worth of certain aspects of life in order to indicate that they are not reducible to monetized values. Such arguments have been put forward to explain a desire to invest in clean air beyond an optimal point.[65] We are, in this argument, entitled to "breathing rights" without making any purchase or engaging in conduct that gives rise to a claim of desert. Similarly, we may wish to signal similar entitlements to a "safe" life, a signal that would be subject to substantial static should we admit openly that life can be balanced against other resources. Such an admission necessarily dehumanizes the subject, and reifies the intangibles of life by placing them on a parallel with commodities subject to market transactions.

Finally, there is a concern that the very process of quantification alters the conclusions that one reaches about the value of human life and thus violates the precepts of neutrality that allegedly underlie any concerted effort to address the issue. For instance, some argue that attempts to quantify the value of individual lives necessarily treats individuals separate and apart from the communities in which they live and "reinforces self-

---

62 MacLean, Social Values and the Distribution of Risk, in D. MacLean, Values at Risk 85-86 (1986) (hereinafter, Social Values); MacLean, Comparing Values (unpublished manuscript).

63 MacLean, Social Values, supra note 62, at 86.

64 See, e.g., Solow, Defending Cost/Benefit Analysis: Replies to Steven Kelman, 5 Regulation 2 (May/June 1981).

65 Tribe, Policy Science: Analysis or Ideology, 2 Phil. & Pub. Aff. 66, 88-89 (1972).

interest as a correct or worthy index of value."[66] By this argument, perhaps understood as a special application of the Heisenberg uncertainty principle in which the measurement process affects outcome, the result would necessarily undervalue life by removing communal values from the process of isolating one individual's worth.

Notwithstanding the cogency of these remarks, we proceed, somewhat unabashed, to analyze efforts to value human life. Our failure to be convinced by the above arguments is based largely on the following responses. First, as a pragmatic matter, it is clear that -- even if we reject the assignment of explicit values -- we as a society constantly engage in the implicit valuation of human life.[67] When we create new technologies that are risk producing, whether they be new machines or drugs to combat disease, we know that the benefits of those technologies carry some degree of cost. Accidents in the production of those technologies, abreactions in consumers, and foreseeable injuries that will result from the negligence of users all reveal that these advances are not risk-free. Nevertheless, we proceed because we believe that even risky technologies may be (net) risk reducing, i.e., they may eliminate a greater quantum of risk than they create.[68] Even if they do not displace greater risks to human life, they may possess other compensating features, e.g., convenience, that offset the risks they pose. Thus, a social decision to proceed in the face of known risks reveals that we (a term that does not necessarily implicate governmental agencies although it has increasingly come to connote them) believe those risks that remain are "worth taking." To the extent that those risks involve threats to human life, we implicitly concur that the value of risks reduced exceeds the value of the lives lost. When we decide to regulate certain activities or not to regulate others, we are implicitly determining that the costs of regulation do or do not exceed the value of lives saved as a result of regulation.

Second, and related to the first, our implicit decisions about human life may be susceptible to some level of quantification. Presumably, we would desire to make the tradeoff between lives and other resources as accurately as possible. If that is the case, failure to attempt any such effort at quantification causes us to generate either too much or too little risk. While one may respond that such a belief ignores the lessons derived from the theory of the second best -- that in the absence of the ability to quantify all variables, it is not necessarily second best to quantify as many as possible -- that theory suggests only that second best solutions may not be preferable to inaction, not that they cannot be preferable.

Third, while there may be something invidious in the quantification process, e.g., in reifying human life or in risking the omission of nonquantifiable variables from the ultimate decision, we do not believe these effects to be inexorable. The effort at determining whether regulations are "worthwhile" in terms of cost per life saved is not necessarily dehumanizing if decision makers are ultimately attentive to both the valuation process and its limits. The desire to consider these factors may help to determine the identity of the ultimate decision maker. For instance, one may consider courts rather than agencies to be more receptive to nonquantifiable variables because courts regulate ex post

---

66 Swartzman, Sources of Controversy, in Cost-Benefit Analysis and Environmental Regulations: Politics, Ethics, and Methods 72 (1982).

67 See, e.g., E. Stokey & R. Zeckhauser, A Primer for Policy Analysis 149-53 (1978); H. Rosen, Public Finance 193 (1985).

68 See Grady, Why Are People Negligent? Technology, Nondurable Precautions, and the Medical Malpractice Explosion, 82 Nw. U. L. Rev. 293 (1988); Huber, Safety and the Second Best: The Hazards of Public Risk Management in the Courts, 85 Colum. L. Rev. 277 (1985).

and are faced with actual victims, whereas the ex ante approach of regulators necessarily limits them to statistical analysis.[69]

Finally, at the very least, efforts at quantification provide regulators with a common metric and thus permit both regulators and those to whom they are accountable access to some measure of the consistency of regulatory action. If one agency refuses to propose regulations on the theory that they will be too costly at a rate of $X per life saved while another agency promulgates regulations that will cost $2X per life saved, those who analyze the regulatory process have a comparative basis for inquiring into the propriety of regulatory action. Similarly, Paul Rubin has suggested that explicit valuations may enhance regulatory goals of maximizing benefits to consumers for the level of spending that society is willing to invest in safety. Rubin suggests if an agency with a fixed budget can spend $20,000,000 on safety in a given year and can select either a method of safety that saves lives at a cost of $1 million per life or a method that saves lives at a cost of $2 million per life, explicit recognition of these values will increase total lives saved (by concentrating all resources into the first method) over random selection of the alternatives (e.g., by investing $10 million in the first method and $10 million in the second).[70] Implicit in this objective is the understanding that once part of our social budget is allocated to safety, it ought to be spent in a manner that maximizes the number of lives saved. This understanding is not necessarily tautological. There may be intuitions that lead us to favor spending in a manner inconsistent with maximum life saving.[71] Nevertheless, we might test the strength of these intuitions by determining how far they deviate from a principle of maximum life saving. In any event, the principle of maximum life saving poses substantial difficulty for the thought that life valuations are inconsistent with respect for the symbolic or sacred value of life. It would be somewhat anomalous to hold life sacred without simultaneously attempting to maximize the number of lives saved. Thus, even the sacredness approach may require some attention to the relative implicit values of regulation for health and safety.[72]

Our review of federal agency practices reflects these concerns. Not all agencies accept the view that valuation of human life is an appropriate governmental enterprise. The most forthright rejection can be found at the National Highway Traffic Safety Administration ("NHTSA"), despite its location within a department, the Department of Transportation, whose regulatory procedures call for quantitative benefits analysis (DOT's "Guidance for Regulatory Evaluations"). NHTSA strongly objects to full benefits analysis of fatality avoidance: "It should be noted that this Agency does not consider it appropriate to place a dollar value on human life or injuries."[73] NHTSA believes that it is useful to quantify the clearly monetizable consequences of accidents, particularly property damage, lost productivity, and medical and legal costs. It acknowledges that these constitute only a subset of all benefits from accident reduction, but it chooses not to value other benefits explicitly. It merely states the number of lives or injuries at risk.

---

69 See Gillette & Krier, Risk, Courts, and Agencies (unpublished manuscript 1988). See also text accompanying notes 125-34 infra.

70 See Memorandum from Paul Rubin to Consumer Product Safety Commission, Feb. 25, 1986.

71 See Fried, The Value of Life, 82 Harv. L. Rev. 1415, 1418 (1969).

72 Id. at 1425.

73 NHTSA, The Economic Cost to Society of Motor Vehicle Accidents 1-2, DOT HS 806342, January 1983.

Other agencies appear to use explicit values sporadically. For instance, memoranda from the Consumer Product Safety Commission reveal use of a $1-2 million valuation of life in discussions concerning regulation of disposable cigarette lighters and bunk beds.[74] Other memoranda reveal no explicit valuation of life, but only elaboration of the per life costs that would have to be incurred in a regulatory effort. For instance, discussions concerning a particular regulation assume a variety of accident avoidance measures with varying costs. On the assumptions stated in the discussion, these cost estimates range from $2.6 million to $312.5 million per life saved. While the discussion does not incorporate any assignment of value for life, one would infer that proceeding with the more expensive regulatory effort reflects a judgment that life is worth that much, while failure to utilize a more expensive alternative that would save more lives reflects a judgment that the expenditure is not justified, i.e., that saving the marginal lives is simply not worth the necessary added expenditure.

None of the above suggests that valuation is a task devoid of computational, ethical, or legal difficulties. Indeed, extraordinary difficulties in any of the above may render the results of any computation so suspect as to undermine the propriety of the effort. In the remainder of this report, we will investigate the extent of those difficulties. At this point we only conclude that those inquiries should not be precluded by any threshold aversion to quantification.

Nevertheless, there may be situations in which monetization of human life has little merit, given the computational and ethical difficulties associated with the project. For instance, where other factors of uncertainty are so dominant as to dwarf potential disagreements about values for life, paying much attention to the latter factor seems unproductive. Assume, for instance, that a particular regulation is anticipated to lessen a risk, but available scientific evidence is too weak to permit reliable quantification of the risk reduction, e.g., the evidence permits only a range of probable reduction at somewhere between 1:10,000 and 1:1,000,000. In this situation, application of a precise figure for human life to diffuse estimates of risk reduction will do little to resolve the question of the proposed regulation's cost-effectiveness. Thus, little is to be gained by evaluating the value of lives saved in this context alone. Short of such situations, however, we believe that the valuation process theoretically generates a more informed and effective decision basis for risk-reducing regulations.

B. Problems of Quantification.

If we knew with certainty the costs of regulation and the number of lives that could be saved by implementing any given proposal, quantifying the value of individual human lives would be unnecessary to achieve the most cost-effective level of regulation. Instead, we could determine an appropriate "life-saving budget" and adopt regulations seriatim, starting with the one that saved the most lives per dollar, until the funds allocated to life-saving were exhausted. Unfortunately, this felicitous scenario is unlikely to materialize as long as implementation costs are uncertain and are calculated differently across agencies. Indeed, even if we could impose some uniform calculus on agencies, we might fear that its wooden application would fail to recognize that we do not treat all deaths equally. Avoidance of cancer deaths might warrant expenditure of more resources than avoidance of an equal number of deaths in automobile accidents, simply because we dread the painful and extended deterioration that accompanies the former. Thus, some mechanism that

---

74 See Memo from Dale Ray to Paul Rubin, May 5, 1987 (cigarette lighters); Memo from Dale Ray to David Thome, September 23, 1987 (bunk beds).

reflects our treatment of different deaths should augment initial rankings of the "most effective" regulations.

On its face, a procedure that values both the costs and benefits of regulation would appear appropriate. Any such procedure ideally would quantify all the consequences of implementing a particular level of life saving. Thus, it would permit a differentiated view of the effects of regulations not possible if all deaths are treated equally. Applying such a mode of analysis to the area of health and safety regulation, however, creates an additional set of difficulties. Cost-benefit analysis poses relatively little difficulty where components of the calculus constitute commodities that are exchanged at competitively negotiated prices in established markets or that are otherwise susceptible to socially acceptable quantification.[75] Thus, a decision by a rational, self-interested, profit-maximizing entity to invest in a device that will cost $X and will replace current production modes that cost $X+1 seems relatively straightforward. The difficulty that pervades cost-benefit analysis involving human life is the absence of any reliable "market price" that can be used as a standard for fair exchange. In the absence of a market, some alternative means must be found for establishing what we are willing to invest in order to save a human life. Human life has value not simply because of the ability of humans to produce goods that do have market values (a function that does permit some measure of the value of human life, often termed human capital[76]) but also because life generates additional values less susceptible to quantification. Within this category lie such factors as "community," "friendship," and the "hedonic" value of life.

In this section we consider the primary approaches that federal agencies have adopted to address this difficult issue of quantification. We trace the history of their use and the relevant methodology. Finally, we consider some of the critiques of each approach and attempt to reach some conclusions about whether those critiques are so substantial as to undermine any utility that the quantification effort might otherwise possess.

1. Initial Efforts; Human Capital Reasoning.

However one might choose to characterize its overall impact, loss of life does have the quite tangible consequence of lessened production and consumption of goods and services. This fact forms the basis for one longstanding approach to the valuation of life, which is often referred to as the human capital approach. Premature destruction of a productive machine would deprive society of whatever output it was capable of yielding over its remaining years of usefulness. The human capital approach relies on an analogy between such productive physical capital and the economic productivity of people. Thus, this approach equates the value of life with the dollar value of goods that can be produced by the person whose life is at risk. In particular, one can estimate the amount of future income that will be forgone if a person's productive effort comes to an early end due to death. This provides one measure of the value of a life.

The human capital concept is quite useful for a number of policy questions. For example, consider the issue of setting priorities for types of capital spending to stimulate economic growth. Not recognizing that human productivity can be increased by outlays on training could lead to an overemphasis on acquiring physical capital. Similarly, if one were concerned with the issue of optimal investment in life insurance to assure a suitable income

---

75 See Baram, supra note 15 at 483; Zeckhauser, Measuring Risks and Benefits of Food Safety Decisions, 38 Vand. L. Rev. 539, 544 (1985).

76 See discussion at text accompanying notes 77-95 infra.

stream in the event of one's death, a human capital approach would be appropriate.[77] Moreover, the concept has practical appeal -- say in debating the merit of further education -- both at the level of the identifiable individual and for large group decisions.

But in the context of fatality-risk reduction, human capital thinking can at best provide incomplete answers, as it considers only losses in national income and fails to consider other losses, including the at-risk individual's own desire to live.[78] Cutting short a human life has a significance that includes but transcends measurable output effects. Mishan reviews some of the early efforts to base life valuation on expected future earnings and identifies conceptual weaknesses.[79] For example, Mishan notes the commonly articulated but rarely satisfied need to buttress estimates of forgone earnings with values for consequences such as pain and suffering and family bereavement. As appealing as this might seem, it moves the analyst well beyond readily available and verifiable data sources. Other than jury verdicts relating to pain and suffering, there exists little basis to assess the amount of money that would compensate for suffering and bereavement.

On the other hand, restricting our measure to forgone earnings, while assuredly facilitating objective estimations, carries with it certain ethically troublesome implications. Any approach based on lost earnings will place low valuations on the lives of those who are neither wage earners nor producers of goods or services in developed markets, for example, retirees and homemakers (although markets have developed for some homemaking functions, e.g., child care and cooking). This can lead to any number of objectionable policy outcomes. Suppose two alternative strategies for hazard reduction would avert the same number of total deaths, but one would disproportionately benefit retirees (which could happen if the region benefiting most from one strategy had an older population). An application of a human capital approach to benefits valuation would make the latter strategy look less warranted. Yet few would find this an acceptable basis on which to make a choice between the two alternatives.[80]

Whether as a matter of social policy we would prefer the alternative that protects a more youthful subgroup may be an unavoidable decision. But using a monetization process that neglects everything but future individual productivity would not clarify or inform the decision; it would merely mask its real implications with the appearance of quantitative objectivity. The underinclusiveness of the human capital approach would be exacerbated if it systematically excluded or undervalued particular components of a "valuable" life. The approach appears to suffer from just such a defect insofar as it provides no mechanism (such as shadow prices) for losses that are unrelated to production or market forces and that are, therefore, difficult to quantify. Examples include pain and suffering, psychic harms, and dread of catastrophic or involuntary risks.

Additionally, human capital approaches may incorporate invidious social effects that reflect lower productive values for persons kept from highly productive jobs for reasons

---

77 See L. Dublin & A. Lotka, The Money Value of a Man (1930); M. Jones-Lee, The Value of Life: An Economic Analysis 21-22 (1976); Linnerooth, The Value of Human Life: A Review of the Models, 17 Econ. Inquiry 52, n.1 (1979).

78 Id. at 53.

79 E. Mishan, Cost-Benefit Analysis 320-45 (3d ed. 1982).

80 This is not to suggest that alternative methodologies are free of such skews. For instance, in a willingness-to-pay approach, discussed infra, it might be that younger people would be willing to pay more than older people to avoid risks of fatality. Cf. Arthur, The Economics of Risks to Life, 71 Am. Econ. Rev. 54 (1981).

Logical, but probably wrong. Young people take greater risks, probably for psychological reasons

having little to do with ability to perform those jobs. For instance, assume that a segment of the population is the subject of employment discrimination. Thus, members of this segment either cannot obtain certain jobs or can obtain them only by accepting a wage less than that of similar workers outside the discriminated group. Assume further that this group is found to be particularly susceptible to a certain disease or injury (e.g., sickle-cell anemia for blacks, Tay-Sachs disease for Jews, breast cancer for women). Finally, assume that these risks could be avoided at a cost of $X. If $X is weighted against the human capital costs of the at-risk group, without taking into account the effects of invidious discrimination on the productive capacity of the group, then the cost effectiveness of the curative will be grossly understated.[81] One variant of the human capital approach common in highway policy circles until 1984 employed an even more offensive assumption that the value attached to a life (reflecting future wages) should be lessened by that individual's future consumption.[82] Then having in the analyzed group some elderly people who consume but do not work would have the bizarre effect of actually valuing certain deaths positively.

Notwithstanding these critiques, human capital approaches provide the benefit of administrative ease.[83] Actuarial tables provide justifiable estimates of life expectancy and projected earnings for those placed at risk. In addition, the ethical concerns have not been so strong as to preclude the widespread use of human capital approaches in a variety of situations. Perhaps most commonly, expected earnings remains the primary component of compensation in wrongful death actions in the judicial system.

In summary, the human capital approach appears most objectionable for its exclusion of factors relevant to value that are not easily translated into terms of productive capacity. Advocates of cost-benefit analysis are not oblivious to these concerns about variables that resist quantification. The response, however, seems largely to take two forms. One is urging those who employ cost-benefit analysis to be sensitive to additional variables not considered in the quantification process. The other is to separate formally the process of quantification from decision making, or risk assessment from risk management.[84]

Unfortunately, neglect at quantification stages of what Lawrence Tribe early described as "soft variables" may preclude their subsequent reintroduction into the policy

---

81 See Acton, Measuring the Monetary Value of Lifesaving Programs, 40 L. & C. Prob. 46, 55 (Autumn 1976); Rice & Cooper, The Economic Value of Human Life, 57 Am. J. Pub. Health 1954, 1960 (1967).

82 Miller, Accident Costs and Safety Policy Decisions, unpublished paper, January 12, 1986 at 2.

83 See Acton, supra note 81, at 52; Arthur, supra note 80, at 54; Cook, The Value of Human Life in the Demand for Safety: Comment, 68 Am. Econ. Rev. 710 (1978).

84 See Ruckelshaus, Risk in a Free Society. On this view, risk assessment is a neutral process, informed solely by pure and objective scientific investigation and measurement. Risk managers, on the other hand, filter the objective data provided by risk assessment through their political roles to determine the proper social policy. Commentators have recognized the difficulty of separating these functions. Uncertainties inherent in the scientific investigation, degrees of confidence in results, and ranges of probability that risks will materialize all raise risk assessment issues that can only be resolved through incorporating the values of the investigator. See Latin, Good Science, Bad Regulation, and Toxic Risk Assessment, 5 Yale J. Reg. 89 (1988).

decision.[85] Decision makers who would ideally reconcile quantifiable data and more ephemeral considerations may be driven by the "hardness" of the former and the abstraction of the latter to rely solely on the data. Quantifiable variables give the decision maker something concrete to point to in order to justify a particular decision and create an impression of scientific impartiality and certainty. Simultaneously, reliance on quantifiable variables, such as expected earnings over a given number of years in a particular occupation, avoids the need to consider other values that compete with economic utility. Thus, Thomas Nagel writes that attempts to resolve conflicts by reference to a single general system, e.g., a quantitative one, bars as "irrelevant or empty all considerations that cannot be brought within the scope of that system."[86]

Indeed, to some extent, legal doctrine invites regulators to ignore certain "soft variables," notwithstanding the very real costs that they involve. For instance, the Supreme Court has determined that the National Environmental Policy Act of 1969[87] did not require the Nuclear Regulatory Commission to evaluate psychological effects on nearby residents prior to approving operation of the Three Mile Island nuclear power plant after a major incident at that facility.[88] Although the Court recognized the existence of such effects, it determined that the statute addressed solely effects of conduct on the physical environment rather than to perceptions of risk.[89]

There is some evidence that soft variables or those external to the general system do not get completely ignored. Social or political values may cause regulators to resist decisions that appear mandated by reference to quantified values alone. Some commentators have explained this phenomenon by reference to the existence of "trumps" in the risk management process.[90] But given the politics of regulation, intervention of trumps would seem fortuitous rather than systematic. Their introduction may depend on whether the affected population has sufficient political power to persuade legislators or regulators of the need for or inappropriateness of regulation. Political capacity may turn on such issues as discreteness of injury and diffusion of the affected population rather than on any merit-based criterion. Thus we are left with a general concern that quantifiable variables take on a life of their own and override other, less quantifiable concerns. Leonard and Zeckhauser similarly suggest that these effects are inevitable.[91] They take comfort, however, in the fact that the skews are not unidirectional. They state:

> But this limitation is itself ethically neutral unless it can be shown that the quantifiable considerations systematically push decisions in a particular direction. In other words, it is not sufficient to argue that cost-benefit analysis does not handle perfectly what is obviously a very hard task; rather, its detractors must show that its errors are systematically unjust or inefficient -- for example, that it frequently helps the rich at the expense of

---

85 Tribe, supra note 65. See also Michelman, Norms and Normativity in the Economic Theory of Law, 62 Minn. L. Rev. 1015 (1978).

86 Nagel, Fragmentation of Value 137, in T. Nagel, Mortal Questions (1979).

87 42 U.S.C. § 4321.

88 Metropolitan Edison Co. v. People Against Nuclear Energy, 460 U.S. 766 (1983).

89 The Court did suggest that risk perception raises an issue of whether a particular technology should be utilized. 460 U.S. at 776. The Court held, however, that any such issue was not implicated in the statutory issue before it.

90 Leonard & Zeckhauser, Cost-Benefit Analysis Applied to Risks: Its Philosophy and Legitimacy 31-42, in D. MacLean, Values at Risk (1986).

91 Id. at 44-45.

> the poor, or that the environment is systematically disadvantaged to the benefit of industry. We have not seen any carefully researched evidence to support such assertions.[92]

Three problems exist with this reasoning. First, those errors that exist do not necessarily cancel each other out. If two decisions are made, one of which adversely affects the rich and the other of which adversely affects the poor, there is no reason to believe that the same parties will be affected or that the inefficient or unfair effects of each decision will precisely (or remotely) offset the other. Second, it is unclear why the burden of proof is on the dissenters. Why not place it on those who desire to use cost-benefit rather than on those who oppose it? Given uncertainty about the validity of an analytical tool, placement of the burden of proof may be determinative of outcome. While there may well be substantial ethical and pragmatic justifications for using some form of cost-benefit analysis, it is unclear why they need not be explicitly proffered by those who would employ such methods. Third, the discussion implies that the process of risk assessment is readily separable from that of risk management. On this view, risk assessors are apolitical technocrats who generate quantitative data based on value-neutral processes and deliver it in pristine fashion to political decision makers.[93] These risk managers then filter the information through a political process that responds to political trumps. Unfortunately, this ideal remains distant from the actual process of risk assessment. As we shall discuss later in this report, political and scientific values are inherent in the decisions of risk assessors to employ certain test procedures, to present data in certain forms, and to select or ignore certain hypotheses. Thus, what risk managers receive, and what they can therefore subject to political trumps, has already been filtered through a rigorous value system.

2. Toward Willingness-to-Pay Approaches.

The inherent limitations on the utility of human capital approaches have led policy makers to seek more acceptable alternatives to the valuation of life. Following a 1968 article by Thomas Schelling,[94] researchers have seized on a theory of valuing life by determining what individuals would be willing to pay in order to reduce the probability of death or what they would accept to have that probability increased.[95] This method, known as the willingness-to-pay approach, assumes that one can get a sense of how people will value a small reduction in the risk of accidental death by examining their behavior in the marketplace. To the extent that it is successful, the willingness-to-pay approach avoids many of the obstacles associated with human capital valuations. For instance, willingness-to-pay assumes that people internalize the "soft variables" excluded from the human capital approach and that they express a monetized value for those factors, e.g., concern for pain, dread of particular types of death, in their marketplace choices for goods, services, and occupation. Additionally, willingness-to-pay provides the normative appeal of consistency

---

92 Id. at 44.

93 See Rowe, Government Regulation of Societal Risks, 45 G.W.L. Rev. 944 (1977).

94 Schelling, The Life You Save May Be Your Own, reprinted in T. Schelling, Choice and Consequence 113 (1984).

95 Conley, The Value of Human Life in the Demand for Safety, 66 Am. Econ. Rev. 45 (1976); Dardis, The Value of Life: New Evidence from the Marketplace, 70 Am. Econ. Rev. 1077 (1980).

with individuals' preferences.[96] People may incorporate into their responses to willingness-to-pay inquiries factors such as the nature of the risk they confront (e.g., voluntary vs. involuntary) and the type of death (prolonged agony or quick and painless) they will suffer should a risk materialize.[97]

Operation of the willingness-to-pay approach is illustrated in EPA's 1983 review of the literature. If, for instance, an individual voluntarily takes precautionary steps that cost $10 and reduce the probability of death in a particular situation from 10 in a million to 5 in a million, then the implied value of life can be computed as $10/.000005 = $2 million.[98] The data most commonly relied on for these purposes are drawn from labor market studies of the wage premium observed in comparisons of jobs varying in their fatality risks (using multivariate regression analysis to isolate the influence of risk). However, other data sources also have been tapped. For example, some studies have drawn inferences from consumer choices ranging from seat belt usage to willingness to take risks through speeding or not using crosswalks (sometimes called hedonic approaches to willingness to pay) and from consumer behavior in the selection of relatively risky products.[99] Others have relied on surveys of consumer attitudes toward actions that lessen risk (sometimes referred to as contingent valuation approaches to willingness-to-pay).[100]

Numerous willingness-to-pay studies have been completed. Viscusi concludes that for typical risk situations, a range of about $2-3 million can be defended, as can higher values for involuntary risk situations. Miller finds credible values of $1.4 million plus or minus 40%.[101] The Environmental Protection Agency's own conclusions about value of life are more guarded, suggesting a range of $400,000 to $7 million in 1982 dollars.[102] Elsewhere, however, EPA staff have suggested $1.5 to $2 million as a reasonable norm,[103] and an EPA staff draft recently identified $1.6 million to $8.5 million as supportable.[104]

3. The Limits of Willingness-to-Pay.

Economic reasoning suggests that willingness-to-pay is theoretically superior to the human capital approach to valuing human life. A person's willingness to pay to avoid a

---

96 For a formal exposition of the assumed decision process involved in deciding the value of reducing risk of death, see Jones-Lee, The Value of Changes in the Probability of Death or Injury, 82 J. Pol. Econ. 835 (1974).

97 See Acton, supra note 81, at 50-51.

98 EPA, supra note 7, at 1-2.

99 For a survey of different studies, see EPA, supra note 7.

100 For an analysis of the credibility of questionnaires and surveys, see Jones-Lee, Hammerton, & Philips, The Value of Safety: Results of a National Sample Survey, 95 Econ. J. 49, 66-71 (1985). The authors report mixed results concerning the veracity and rationality of responses, but find that results from questionnaires concerning the value of life parallel results obtained through revealed preference studies, i.e., about £1.25 million in 1981 prices. See id. at 71.

101 Miller, supra note 82, at 15.

102 EPA, supra note 7, at 6-3.

103 Luken, National Research Council at 13.

104 See note 11 supra.

risk presumably incorporates that individual's valuation of factors that are difficult to measure independently, and thus this approach necessarily considers nonquantifiable variables that cost-benefit analysis is typically accused of ignoring. For instance, consider an individual who could purchase either of two gasoline lawn mowers that are identical in all respects other than that one of them contained a one-gallon tank of gas and the other contained a two-gallon tank. If a consumer were willing to pay $10 more for the latter, we could infer that the convenience of less frequent fillups was worth $10 to that consumer. Thus, we could quantify a soft variable, convenience, that is easily overlooked and for which there is no market for exchange from which to derive an explicit value. Similarly, willingness-to-pay may reveal values for aspects of safety not otherwise readily quantifiable.

This advantage of the willingness-to-pay approach, however, should not be understood as a panacea for the problem of the immeasurable. The limitations of willingness-to-pay fall into several general categories. The first is mobility. Information extracted from labor studies must assume jobs and wage rates that are accepted volitionally, without exogenous constraints. In fact, however, jobs and wage rates may be accepted under conditions in which alternatives are restricted by mobility or cultural considerations that limit the horizons of workers.

The second problem is informational. Willingness-to-pay serves as a useful measure of value only where the expressed preferences are based on knowledge that accurately reflects both the payer's probability of death and the losses that will occur should that risk materialize. The need for such information suggests that willingness-to-pay approaches may be of limited utility where actors are ignorant of or systematically miscalculate the relevant variables. Because this information may be difficult to obtain, investment in search may be rational only where decisions that incorporate the information occur with some regularity. In short, repeat players may be willing to obtain the relevant information, while single- or infrequent-play players may not. For instance, individuals may want to seek out risk information in decisions to engage in particular occupations, since those risks will be confronted continuously during the course of employment. Thus, Viscusi and O'Connor report that chemical workers perceive occupational risks that do not deviate significantly from objective measures.[105] A consumer considering which hedge trimmer to purchase, however, may avoid inquiries into relative risk among models as the search for that information will seem too costly given the infrequent use the consumer expects to make of the product. Indeed, there exists some evidence that regulation may (perversely) *enhance* tendencies to ignore risks. Viscusi notes a lack of "clearcut evidence of a significant beneficial effect on product safety" from Consumer Product Safety Commission regulations, some of which were intended to convey information to consumers. Indeed, accidental poisonings, Viscusi finds, did not decrease after the advent of safety caps, perhaps because of a "lulling effect" that regulation had on risk perception.[106]

Even if they are more likely to consider risks, repeat players such as employees may be subject to other biases that cause them to misapprehend the level of risk to which they are exposed and thus to misstate what they would be willing to pay or accept to reduce that risk. The literature of cognitive dissonance suggests that those who find themselves in risky situations without an easy way of escape are prone to deny the existence of the risk.

---

105 Viscusi & O'Connor, Adaptive Responses to Chemical Labeling: Are Workers Bayesian Decision Makers?, 74 Am. Econ. Rev. 942 (1984).

106 Viscusi, Consumer Behavior and the Safety Effects of Product Safety Regulation, 28 J. L. & Econ. 527 (1985).

Any alternate view would require the actor to recognize that he or she has made a choice that is inconsistent with the actor's preference for thinking well of himself or herself, e.g., that the actor made a decision about employment that is personally safe.[107] Note that this phenomenon is likely where actors discover risks of choices previously made; known risks of future projects can be factored into the the decision whether to undertake the project. Nevertheless, where workers become aware of risks that attend the jobs they have held, or become aware of risk-reducing technology that they could employ at their jobs, they may fail to adjust their behavior to take into account the risks or the new technology.[108] Similarly, they are likely to understate their willingness to pay to avoid those risks, as such payments would implicitly recognize the hazards of their occupation. Thus, willingness-to-pay evidence obtained from such individuals cannot be equated with rational decisions about the value one places on one's life.

The third problem of willingness-to-pay is the presence of externalities. Even an accurately computed willingness-to-pay amount predicated on all available information will reflect only those losses that the payer seeks to avoid. Thus, externally imposed losses, e.g., losses suffered by those other than the payer and his or her immediate family, may not be reflected in the calculation at all. Assume, for instance, that an individual is willing to take a slightly more risky job, but only if it pays a somewhat higher wage. The wage differential will reflect the value to the worker of the change in risk of death. If the worker were to fall victim to an accident of the type that made the job risky, however, all the consequent losses might not be internalized by the worker. While the potential loss shared by close relatives and friends might be reflected in the worker's decision, and the loss felt by the employer might be reflected in market transactions with consumers of the goods produced by the employer, the loss felt by others -- co-workers, more distant relatives and acquaintances -- would not be reflected in the worker's calculations at all. Nevertheless, these individuals could feel real and substantial losses. Thus, the willingness-to-pay approach, while generally rendering a higher value for life than the human capital approach, will systematically undervalue life.[109] On an alternative view, however, externalities will lead to systematic overvaluation. Individuals will not, in valuing their own lives, consider the benefits conferred on others in the form of increased opportunities for consumption as a result of the death of a would-be consumer.[110] This view, however, fails to balance

---

107 See Akerlof & Dickens, The Economic Consequences of Cognitive Dissonance, 72 Am. Econ. Rev. 307, 308 (1982).

108 Id. at 316.

109 We are not here concerned with a second type of external effect, i.e,. the failure of wage rates to reflect risks of death that workers may impose on others. For instance, the Environmental Protection Agency's analysis of vinyl chloride, discussed above, was based on additional cancers that would be suffered by residents living near plants rather than by workers. It is unlikely that even fully informed employees not at risk would demand wages that reflected risks imposed on non-workers. To the extent that those at risk are not consumers of the risky product, consumer prices are similarly unlikely to reflect amounts that those at risk would be willing to pay to avoid a hazard. Nevertheless, those at risk would presumably be willing to pay something to reduce their risk, if only there were a market in which they could effect the transaction. In a recent article, Viscusi, Magat, & Forrest, Altruistic and Private Valuations of Risk Reduction, 7 J. Pol. Anal. & Management 227 (1988), the authors relate evidence that individuals are willing to act altruistically to reduce risks to others. The level of altruism, however, is limited and dissipates with the geographical distance between the actor and the beneficiary.

110 See Arthur, supra note 82, at 62.

increased consumption against decreased production which may also follow from the death of one of society's members.

Some risks present both the externalities problem and the informational problem. For instance, the Nuclear Regulatory Commission must determine whether proposed measures are necessary to ensure "adequate protection" of human health from the risks created by nuclear power plants.[111] A willingness-to-pay basis for measuring the cost effectiveness of a proposed improvement would confront two difficulties. First, those affected by a nuclear accident will not necessarily be limited to "expert" workers or others who have information about the risk they face. Thus the low probability of such an accident is likely to distort the relationship between expressed willingness-to-pay and the actual risk. Second, any such accident will likely generate substantial external effects that will not be included in willingness-to-pay evidence. The person placed at risk will not necessarily discriminate between the consequences of death in a nuclear holocaust and death in an automobile accident. Either case poses similar consequences for friends, relatives, and others who depend on the victim. The former risk, however, constitutes a catastrophe that threatens additional injuries through the loss of community, monumental stresses on medical and social facilities, and the possibility of substantial economic dislocations in the larger society.[112] While some have suggested that catastrophe poses no greater costs than the aggregate of an equivalent number of individual losses,[113] there is evidence that total losses are greater in the former case.[114]

Infrequency of exposure suggests the fourth problem of the willingness-to-pay approach: cognitive limits on the information utilized in the underlying calculus. For the most part, the risk of death related to products or to occupations is quite small. Infrequency does not affect either the desirability of considering the risk or the technical ability to calculate its value.[115] Even with small risks, expected losses can be derived by multiplying the probability times the loss that will occur should the risk materialize. Expected utility theory suggests that rational decision making would be guided by these precepts.[116] Developments in cognitive theory, however, suggest that individuals seriously deviate from results dictated by expected utility theory where probabilities are small.[117] These errors may at times generate underassessment of a risky event's

---

111 42 U.S.C. §2232(a).

112 See Spangler, A Critique of Methods in the Quantification of Risks, Costs and Benefits in the Societal Choice of Energy Options 119, 125, in 10 Annals of Nuclear Energy (1983).

113 See Nichols & Zeckhauser, The Perils of Prudence, Regulation, Nov./Dec. 1986 at 23.

114 See, e.g., K. Erikson, Everything in its Path: Destruction of Community in the Buffalo Creek Flood (1976); Rabin, Dealing with Disasters: Some Thoughts on the Adequacy of the Legal System, 30 Stan. L. Rev. 281 (1978); Rosenberg, Class Actions for Mass Torts: Doing Individual Justice by Collective Means, 62 Ind. L. J. 561, 576-77 (1987).

115 On the error of ignoring remote probabilities, see D. Parfit, Reasons and Persons 73-75 (1986); Shrader-Frechette, Parfit and Mistakes in Moral Mathematics, 98 Ethics 50, 54 (1987).

116 See K. Arrow, Essays in the Theory of Risk-Bearing 52-68 (1974).

117 See, e.g., Ayres & Sandilya, Catastrophe Avoidance and Risk Aversion: Implications of Formal Utility Maximization, 20 Theory and Decision 63 (1986); Dardis, supra note 95, at 1081 (realizing limits to model that would require individuals to distinguish between

occurrence and at times may generate overassessment. If the risk is not salient to the actor, as may be the case where injuries materialize only after significant latency periods, then actors are unlikely fully to consider the risk in determining what wage to demand in return for the exposure. This may particularly be a problem where risks are infinitesimal, notwithstanding that they create substantial losses should they, in fact, materialize.

If, on the other hand, the actor can readily call to mind examples of a risk's materialization, the actor is likely to demand compensation in excess of the expected loss of the risk. In this latter situation, known in cognitive theory as the "availability" heuristic,[118] the actor may designate recent or easily recalled events as common, notwithstanding that their appearance does not affect their statistical infrequency. Whether risks are recalled with too much or too little frequency, it can be anticipated that the expressed willingness of individuals to pay to avoid the risk will fail to reflect the actual probability of the risk and will thus deviate from what those same individuals would have been willing to pay had they been cognizant of more accurate probabilities. Here again, there is some evidence that those with frequent exposure to risks or information about risks ("experts") may more accurately predict the probability that a remote risk will materialize. Thus, willingness-to-pay evidence may be more credible when derived from experts than from those whose data base is suspect.[119]

Some of the biases inherent in evaluating infrequent risk may be avoided by questionnaires that make the risks salient to the respondent.[120] This possibility, however, creates an additional danger of the willingness-to-pay approach -- one related to the manner in which risks are presented to respondents. Individual preferences for particular actions may depend on the context in which a decision arises or the manner in which a particular decision is framed. The acceptability of social policies may even vary depending on whether the results are classified in terms of lives lost or lives saved, notwithstanding that the social consequences are identical in each case.[121] Additional biases may be apparent if

---

probability reductions of 2×10^{-6} and 4×10^{-6}); Kahneman & Tversky, Prospect Theory: An Analysis of Decision Under Risk, 47 Econometrica 263 (1979). But see Brookshire, Thayer, Tschirart & Schulze, A Test of the Expected Utility Model: Evidence from Earthquake Risks, 93 J. Pol. Econ. 369 (1985) (property values in California reflect reaction to low-probability risks consistent with expected utility model).

118 Tversky & Kahneman, Judgment Under Uncertainty: Heuristics and Biases, 185 Science 1124, 1127 (1974); Taylor, The Availability Bias in Social Perception and Interaction 190, in D. Kahneman, P. Slovic & A. Tversky, Judgment Under Uncertainty: Heuristics and Biases (1982). For applications to legal theory, see Gillette, Commercial Rationality and the Duty to Adjust Long-Term Contracts, 69 Minn. L. Rev. 521 (1985); Robinson, Rethinking the Allocation of Medical Malpractice Risks Between Patients and Providers, 49 L. & C. Prob. 173 (Spring 1986); Schwartz & Wilde, Imperfect Information in Markets for Contract Terms: The Examples of Warranties and Security Interests, 69 Va. L. Rev. 1387 (1983).

119 See Slovic, Fischhoff, & Lichtenstein, Facts & Fears: Understanding Perceived Risk 182, 191-92, in R. Schwing & W. Albers, Societal Risk Assessment: How Safe is Safe Enough? (1980).

120 See, e.g., Acton, supra note 81, at 62-64.

121 Tversky & Kahneman, The Framing of Decisions and the Psychology of Choice, 211 Science 453 (1981). In this work, the authors relate an experiment in the consequences of framing in which a group of students were asked to choose between two alternative programs to combat an expected outbreak of a disease from which 600 people would die unless one alternative program was adopted. The first alternative was stated as one that

we relax the assumption, implicit in the analysis to this point, that methods of valuation that seek to assess what an individual would be willing to pay to decrease a risk of death (e.g., consumer product studies) are functionally equivalent to methods that seek to discern what an individual would demand in order to take an increased risk of death (e.g., labor market studies for risky jobs). Contrary to this assumption, some research suggests that individuals may value resources differently depending on whether they are paying to obtain an entitlement (receive a gain) or demanding compensation for the surrender of an existing entitlement (avoid a loss). If the entitlement had a constant value, an individual would demand as compensation an amount equivalent to what the individual would be willing to pay to maintain the resource. But there is evidence that individuals have asymetric attitudes towards gains (or maintaining the status quo) and losses.[122] Thus, an abutter of a pristine lake might demand more of a potential polluter than the same person would personally spend to maintain a clean lake.[123]

The implications of deviations between "offer" (purchase) prices and "asking" (compensation) prices for valuation procedures are theoretically quite substantial. Since asking prices generally exceed offer prices, labor market studies that measure wage premiums for exposing oneself to additional risk would be expected to state values higher than those derived from studies of what consumers would pay for safer products or more adequate warnings. In fact, however, studies of consumers and workers differ in methodology sufficiently to call into question whether mortality risks are being valued differently because of the perspective of the evaluator or the appraisal method utilized. Thus, even the same investigator may apply different investigative techniques that explain variations in results.[124]

---

would save 200 people while the second alternative was stated as one that caused a 1/3 probability of saving 600 people and a 2/3 probability of saving no one. Seventy two percent of the group chose the first alternative. Another group was presented with the same threat and the following alternatives: one that would cause 400 deaths and one that created a 1/3 probability that nobody would die and a 2/3 probability that 600 people would die. Seventy-eight percent of this group selected the second alternative. See Tversky & Kahneman, Rational Choice and the Framing of Decisions, 59 J. Bus. S231 (1986). But see Fagley & Miller, The Effects of Decision Framing on Choice of Risky vs. Certain Options, 39 Org. Behav. & Human Decision Processes 264 (1987) (concluding that effect of framing may be less robust than previously reported).

122 Empirical data to support the disparity is offered in Knetsch and Sinden, Willingness-to-Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures Value, 99 Q. J. Econ. 507 (1984). See Kelman, Consumption Theory, Production Theory, and Ideology in the Coase Theorem, 52 S. Cal. L. Rev. 669 (1979); Hoffman & Spitzer, A Reply to Consumption Theory, Production Theory, and Ideology in the Coase Theorem, 53 S. Cal. L. Rev. 1187 (1980).

123 See A. Polinsky, An Introduction to Law and Economics 123-26 (1983); Note, An Economic Analysis of Tort Damages for Wrongful Death, 60 N.Y.U.L. Rev. 1113, 1122-27 (1985).

124 See, e.g., Moore & Viscusi, Doubling the Estimated Value of Life: Results Using New Occupational Fatality Data, 7 J. Pol. Anal. & Man. 476 (1988) (using new series of data that increases implied value of human life). Viscusi's work on consumer risk valuation concentrates on morbidity or injury risk rather than mortality risk. See, e.g., W. Viscusi & W. Magat, Learning About Risk: Consumer and Worker Responses to Hazard Management (1987); Viscusi, Magat, & Forrest, Altruistic and Private Valuations of Risk Reduction, 7 J. Pol. Anal. & Man. 227 (1988).

Neither the offer nor the asking price necessarily represents a "correct" value of life.[125] Agencies could, of course, incorporate different values for different regulatory schemes. Thus, a regulation that required warning labels for risky products might be cost-effective at a level lower than a regulation governing clean-up of toxic waste dumps, even though the number of lives at risk was the same in the two cases. Alternatively, regulations that are cost-effective from one perspective might not be cost-effective from the other. Assume, for instance, that offer prices imply a value of life in the $1-2 million range while asking prices imply a $3-4 million figure. A regulation that cost $2.5 million per life saved would only be implemented on pure cost-benefit reasoning if the latter figure were used. Obviously, this problem increases with the magnitude of the variation in offer and asking prices. Minor variations are unlikely to render the efficiency of a proposed regulation dependent on the selection of a maintenance or compensation standard for valuing lives.

4. Ex Ante/Ex Post Losses and the Use of Jury Awards.

Our discussion to this point has underscored one particular feature of hazard rulemaking -- its focus on statistical lives. That is to say, these rules recognize that a particular activity puts life at risk; based on historical experience, projections can be made concerning the number of lives so risked. Administrative regulation, however, takes place ex ante, before any of the people actually placed at risk can be identified individually. Although ex ante regulation may be able to narrow the group from which the ultimate victims will come, e.g., workers in a particular industry or consumers of particular products, we cannot more precisely predict who will fall victim to society's desire to pursue the activity, notwithstanding its inevitable human cost. It is within this context that regulators assign values to life and consider the offsetting benefits.

Once the risk materializes, however, we typically are able to identify the individual victim. At this point, a particular application of the "soft variables" discussed above comes into play. Once we must make a decision ex post whether to save an individual life, we do not withdraw to a naked statistical analysis of the cost effectiveness of the effort. Certainly, our attitude is not, "if the risk was not worth saving prior to its materialization, it is not worth saving now." Instead, we appear willing to invest almost limitless resources in saving identifiable individuals who, from an ex ante perspective, were not worth saving from exposure to risk. Readily available examples include miners trapped in mines that might have been made safer (at a cost earlier deemed unwarranted), earthquake victims buried under the rubble of buildings (previously considered safe enough), or children trapped in wells (theretofore considered not worth plugging). Numerous commentators have suggested that the kinds of regulatory calculations that generate safety and health standards have no applicability to these ex post cases.[126] We seem not only to recognize the "sacred value" of human life when it is made so salient. We may also be moved by some sense of equity to attempt a rescue the cost of which exceeds the ex ante statistical value of the victim. Having rejected (at least implicitly) precautionary action as too costly, we subsequently have a particular threatened victim on our hands. Once we know who must pay the cost of conferring the benefits (namely, avoiding costs of ex ante reduction of

---

125 For discussions of the offer-asking problem, see Carlson, Reforming the Efficiency Criterion: Comments on Some Recent Suggestions, 8 Car. L. Rev. 39 (1986); Kennedy, Cost-Benefit Analysis of Entitlement Problems: A Critique, 33 Stan. L. Rev. 387 (1981); Markovits, Duncan's Do-Nots: Cost-Benefit Analysis and the Determination of Legal Entitlements, 36 Stan. L. Rev. 1169 (1984).

126 See Calabresi & Bobbit, Tragic Choices (1978); Sagoff, Sense and Sentiment in Occupational Safety and Health Programs, 179, 183, in D. Nelkin (ed.), The Language of Risk: Conflicting Perspectives on Occupational Health (1985); Schelling, supra note 94.

hazards) on the rest of us, it seems appropriate to reduce the burden to that threatened victim, especially when we can do so without losing all the benefits that we have captured by imposing the obligation to sacrifice on some theretofore anonymous victim. It may well be for these reasons that the Environmental Protection Agency, in its thorough 1983 survey of risk reduction valuation approaches, states that: "(a)lthough there is not a clear consensus in the literature, the arguments for the use of ex ante, unidentified risk valuations in policy evaluation are persuasive."[127]

This ex ante/ex post distinction suggests why jury verdicts and settlements in wrongful death cases might be an inappropriate basis for regulatory life valuations. Those awards focus on the particular earnings and family situation of a known individual, for quite plausible reasons. It is commonplace in these proceedings for evidence on income loss to figure importantly in outcomes. Yet certain factors imply that juries would use their substantial discretion, especially where they may consider pain and suffering, to assign high values to life. Juries in such cases will be determining damages only after a finding of liability, of wrongdoing by a defendant. It is conceivable that, faced with a negligent or otherwise blameworthy actor, juries will tend towards overcompensation as a punitive measure.

In addition, juries are not repeat players; they look only at the effects of a particular case. Each jury that considers damages may fail to consider the cumulative effects of overcompensation in the aggregate of cases. Thus, total or average jury awards are likely to represent an example of the "tragedy of the commons" phenomenon in which individual action -- while relatively harmless in isolation -- can accumulate to produce major social dislocations.

Interestingly, while these biases suggest that jury verdicts will produce ex post life valuations that are "too high," existing research indicates that verdicts are uniformly below the generally accepted willingness-to-pay figures. Machol states:

> All such methods come out with values under one million dollars per life. In the case of settlements by insurance companies in major aircraft accidents, the average 10 years ago was under $200,000 and is now several times as large, though still less than one million dollars.[128]

Viscusi reports that: "The average bodily injury payment for fatalities in product liability cases is about $212,000 (1982 dollars) . . . ."[129] Finally, Miller found that "the average jury award for wrongful death . . . has risen to about $1,000,000."[130] Nevertheless, Miller believes that as the willingness-to-pay approach becomes more firmly established in the regulatory area, it will have the indirect effect of driving up jury awards in wrongful death cases, substantially narrowing currently observable valuation discrepancies.[131]

Values derived for wrongful death purposes are not frequently utilized now in regulatory settings, but they nevertheless continue to attract some regulatory attention. In

---

127 EPA, supra note 7, at 5-2. Much the same point is made in OMB, supra note 5, at xix-xxii.

128 Machol, How Much Safety?, 16 Interfaces 4 (Nov./Dec. 1986).

129 Viscusi, in Bentkover at 202.

130 Miller, supra note 82, at 5 as well as Federal Highway Administration, Alternative Approaches to Accident Cost Concepts: State of the Art.

131 Id.

its current guide (issued in 1981) for valuing life, the Federal Aviation Administration noted approvingly that, while the FAA valuation methodology is not a human capital one, the value it yields "approximates the average 1979 judicial settlement of $503,000, after making an allowance for inflation."[132] Moreover, vestiges of human capital reasoning linger on in some regulatory areas, mainly at the National Highway Traffic Safety Administration according to Miller.[133] But on the whole, human capital valuation in regulatory situations has lost whatever adherents, e.g., OSHA, it formerly had.

A final point reinforces the argument implicit in what we have said to this point concerning vicissitudes in human life valuation in different contexts. Even from an ex ante perspective, lives may carry different values depending on whether we are talking about certain death for a given number of unknown persons or a risk of death for a larger group of persons, so that the expected deaths in the two groups are equal. Assume, for instance, that we must decide which of two strategies to follow. One will avoid certain death to a single, unidentified individual in a population of 100,000. The other will reduce to zero a risk that otherwise would cause to each individual in the same population a 1 in 100,000 risk of death. If the two strategies cost the same, is there reason to favor one over the other? In a survey based on these alternatives, Jones-Lee, Hammerton, & Philips found that respondents did care about which alternative was selected, with a mild preference for avoiding the certain, but anonymous, death over the purely statistical one.[134] Nevertheless, such preferences will not be reflected in willingness-to-pay studies that draw on contexts that fail to distinguish among the various situations in which valuations of life are required.

These criticisms of the willingness-to-pay approach strongly suggest that the methodology is inappropriate for defining an exact figure that represents the value of human life. Failure to accomplish that objective, however, does not necessarily render willingness-to-pay studies irrelevant to agency determinations of regulatory impact. If incorporation of soft variables and externalities and correction of informational and cognitive errors did not produce figures for the valuation of human life several magnitudes greater than the flawed processes currently used, then it is unclear that existing distortions would make substantial difference in many cases. For instance, if imperfect willingness-to-pay studies support a human life valuation of approximately $5 million,[135] then even a perfectly performed valuation (assuming such a method could be designed) may not justify implementation of a regulation that cost $50 million per life saved if the corrections incorporated in the study did not justify a tenfold increase in the value of human life. Our critique of willingness-to-pay, therefore, should be understood less as an appeal to ignore these studies than as a warning to understand their limitations. Acceptance of findings from these studies should be viewed most skeptically where they produce dollar values close to the cost per life of proposed regulations, for it is in those situations that failure to consider all relevant variables will have the greatest impact on ultimate result.

IV. Discounting -- A Hybrid Philosophical and Economic Issue

1. Introduction.

---

132 FAA, Economic Values for Evaluation of FAA Investment and Regulatory Programs 27.

133 Miller, supra note 82, at Table 1.

134 See Jones-Lee, Hammerton, & Philips, supra note 100, at 64.

135 See Moore & Vicusi, supra note 124.

The decision to regulate a suspected health or safety hazard represents a judgment that some mandated change in behavior or circumstance will lessen the risk of illness or accident. The decreased risk constitutes a social benefit, valuation of which constitutes the central concern of this report. The mandated change typically imposes burdens on those required to comply with the regulation. (If it did not, i.e., if the benefits of the risk reducing measures could be captured -- through market measures or otherwise -- by those required to take them, presumably risk reduction would occur voluntarily.) These benefits and burdens, however, may occupy very different temporal frames. The benefits of regulation often will not be realized until a substantial period of time after their costs have been incurred. This is particularly the case where benefits take the form of avoiding injuries or illnesses characterized by long latency periods. For instance, in reviewing a proposed rulemaking concerning coke ovens, OMB assumed that cancers would typically not materialize for seven years after the exposure that would be avoided through regulation. If one defines the "injury" that regulation addresses as the manifestation of the cancer rather than the initial exposure, there is a significant temporal gap between the period in which the costs necessary to avoid the exposure are incurred and the point at which benefits of injury avoidance materialize. In cases of substantial latency periods, e.g., storage of nuclear waste where current regulations may prevent harms from materializing in 10,000 years,[136] the benefits of current regulations may be conferred on those who have little relationship to the individuals who incur the attendant costs.

This temporal disparity of costs and benefits raises issues of both philosophical and economic importance. These issues center on the use of "discounting" to enhance the comparability of regulatory options.[137] Discounting attempts to factor into any regulatory analysis the assumption that dollars invested in regulation presumably would otherwise have been invested in productive ventures with a positive rate of return. Thus, during the period between imposition of costs and realization of benefits, the dollars invested in regulation bear an opportunity cost equal to the productive value they would have generated through an alternative investment. As an economic matter, any comparison of the costs and benefits of a particular regulation should place these effects on a common basis by referring to their values at the same point in time. Discounting accomplishes that task by reducing the expected benefits to their present value or increasing the value of current costs to the period when benefits will be realized.

A simple example may illustrate the point. Adoption of one regulatory alternative may impose $10 million in compliance costs this year and none thereafter, while a second imposes $5 million this year and $5.5 million in two years. If both yield much the same payoff in social benefits (e.g., either measure would prevent 10 deaths in 10 years), how do we decide between the two? To say that the second alternative is $500,000 more costly ignores the fact that deferral lightens any burden, because interest can be earned until the cost is imposed. Discounting provides a sounder basis for comparison, as it takes into account the forgone earnings that the first alternative entails. We need "only" know the applicable interest rate to complete the analysis.

Obviously, discounting can have substantial impact on the relative merits of proposed regulation. For instance, in the coke oven example cited above, OMB estimated

---

136 See Murauskas & Shelly, Local Political Responses to Nuclear Waste Disposal, Cities 157 (May 1986).

137 We use "discounting" to refer to two distinct but related economic phenomena. Strictly speaking, "discounting" refers to the question of the present value of benefits that will not be received until some point in the future. Our discussion also involves "compounding," which refers to the question of the value in the future of a benefit received at present.

that the proposed regulations would cost approximately $2.2 million per life saved. These savings, however, would not be realized, under OMB calculations, for approximately seven years. Assuming an interest rate of 10%, the value of a current expenditure of $2.2 million per life doubles to $4.4 million over that seven year period. Thus, if one were to assume that a statistical life were worth approximately $2 million, the regulation might appear reasonable under a regime that compared undiscounted costs and benefits, but not once discounting entered the picture.

Alternatively, one may reduce (discount) future benefits to their present value to equate temporally costs and benefits. Thus, if a life worth $2 million will only be saved seven years hence, its discounted value today (again assuming a 10% interest rate) will be worth only about $1 million. Thus, a regulation that requires current expenditures in excess of $1 million per expected life saved would not be worth implementing on a pure cost effectiveness rationale. While this procedure may crudely be referred to as "discounting lives," it may more euphemistically be considered a comparison of the benefits of regulation with the benefits forgone by not investing the same dollars in some alternative enterprise. As a matter of economics, consideration of these opportunities is appropriate, as they constitute a loss of welfare from rendering the benefits of an investment unavailable for immediate consumption or reinvestment.[138]

Behind the logical force of discounting, however, lurks a semantic distinction that calls the propriety of the enterprise into question. We have to this point interpreted the assumed benefits of regulation as the avoidance of injury or illness that would otherwise materialize with a stated level of probability. It is the existence of a latency period between exposure to a hazard that generates the injury or disease and the onset of that adverse effect that requires attention to intertemporal costs and benefits. While the latency period properly measures the time between exposure and onset, however, avoidance of the injury at the end of that period does not necessarily constitute the salient benefit of regulation. Instead, one may consider regulation beneficial insofar as it reduces or totally avoids the risk that the injury or illness will materialize. *That* effect (risk reduction) arguably materializes as early as the time when the costs of regulation are incurred. In some cases, costs will be extended over a substantial period of time and risk reduction will not materialize until substantial investments have been made. Incremental cleaning of a heavily polluted water supply may be an example of such a phenomenon. Alternatively, risk reduction may be attained only through investment in a step good, so that no reduction occurs until a substantial investment has been made over a period of time. In such cases, the discounting issue remains, as there is still a temporal disparity between incurring costs and obtaining the benefits of risk reduction. Nevertheless, risk reduction may materialize before the latency period expires. Then the effect of discounting for any given discount rate will be less significant than if the discounted benefit were defined solely as the avoidance of the injury at the end of the latency period. In other cases, incurrence of costs and risk reduction will be simultaneous, e.g., the removal of asbestos insulation from a building. In such a case, defining risk reduction as the regulatory benefit effectively eliminates the need for discounting. At the very least, the risk reduction period eliminates certain costs, such as those related to anxiety otherwise produced in an exposed population concerning whether they will ultimately contract the feared disease.[139]

---

138 See Baumol, On the Social Rate of Discount, 58 Am. Econ. Rev. 788 (1968).

139 For cases dealing with liability for anxiety within an exposed population about contracting subsequent disease or injury, see Hagerty v. L & L Marine Services, Inc., 788 F.2d 315 (5th Cir. 1986); Sterling v. Velsicol Chemical Corp., 647 F. Supp. 303 (W.D. Tenn. 1986); Eagle-Picher Industries, Inc. v. Cox, 481 So. 2d 517 (Fla. App. 1985); Payton v. Abbott Labs, 386 Mass. 540, 437 N.E.2d 171 (1982).

There is substantial logic in using the risk-reduction period rather than the end of the latency period (the time between exposure and manifestation of injury) as the benchmark of benefit. Assume, for instance, that a carcinogenic agent were removed from an environment in which it presented a .001 probability of causing cancer. But for removal of the agent, it would have been most unlikely that an individual exposed to that environment would contract cancer. Nevertheless, we would not say that the individual received no benefit from the removal. Instead, we would say that the individual benefited from elimination of a .001 chance of contracting cancer. But if that is the case, then that benefit materialized not at the end of the latency period for the carcinogen, but at the time when the risk was removed, i.e., when the costs of removal were incurred. Since the costs and benefits occurred simultaneously, there is no need to discount.

Nevertheless, exclusive focus on the risk-reduction period could lead to questionable, if not perverse, results. Assume, for instance, that we could spend $x on either of two programs. Program A would immediately remove a risk expected to cause the deaths of 100 people in 5 years. Program B would immediately remove a risk expected to cause the deaths of 100 people in 20 years. Our intuition is that most people would prefer to spend the available funds on Program A. Perhaps this conclusion would be justified because more of the people who would be saved by implementing Program B can be expected to die of other causes during the latency period. Alternatively, saving lives sooner might be viewed as a benefit insofar as it permits quicker growth of the population (on the questionable assumption that having more people sooner is a benefit). If our intution is correct, however, then the objective that it seeks to attain can be reached only by focusing on the latency periods of the harms avoided by the two Programs. Focus on the risk reduction period alone leads one to be indifferent between the two Programs as they immediately reduce the same quantity of risk. The only way to use risk reduction as a benchmark in this example and still reach the intuitively correct result is to consider the time period when lives will be saved when comparing the costs of risk reduction to their benefit. That inquiry, however, reintroduces the discounting quagmire through the back door.

Notwithstanding the complexity of these arguments, current federal government practice is to discount benefits from the end of the latency period. In the remainder of this section, therefore, we will evaluate the arguments and methodology concerning discounting. In our discussion, we will refer to the time between exposure to a risk and onset of the related illness or injury as a latency period and to the gap between incurring the costs of risk reduction and materialization of risk reduction as the pre-reduction period.

2. The Arguments Against Discounting.

Notwithstanding the economic logic of discounting, the procedure has met with considerable philosophical debate. To some extent, the temporal divergence of those who benefit from injury avoidance and those who pay for it suggest that discounting may be necessary to reduce intergenerational inequities. As latency periods and pre-reduction periods increase, the question of discounting raises the issue of the extent to which we owe obligations to future generations. Should full costs of injury avoidance be incurred by the present generation while benefits are realized only in the future, those future individuals who benefit from current investment in safety will bear none of the commensurate burden. Simultaneously, injury avoidance costs borne by the present generation will constitute forgone opportunities for current consumption or alternative investment that might provide a very different temporal mix of benefits and burdens.

For the most part, however, the philosophical debate reflects a different view of intergenerational justice. For instance, some commentators contend that since the question of when one exists is purely a matter of fortuity, discounting benefits to justify current

consumption at the expense of future generations accords to the latter an insufficient level of respect.[140] Implicit in this view is the (debatable) view that future generations will share the preferences of the current generation. Thus, it is anticipated that they will value the same amenities of life that are currently cherished. Should preferences change in some unexpected way, we would be faced with the extraordinary difficulty of predicting future concerns and comparing the worth of intertemporal preferences.[141] If preferences adapt to what is currently available (a "sour grapes" approach to amenities), then it is likely that future scarcity imposed by curent consumption will not necessarily adversely affect the enjoyment of future generations. Assume, for instance, that future generations value wilderness areas less highly than the current generation does. If that change were to materialize, future generations would look askance at current decisions to forgo technological advances in order to preserve natural settings for posterity.[142]

Putting to one side the difficulties of changed preferences, discounting raises serious issues of the relative importance of succeeding generations. Derek Parfit has argued, for instance, that applying a social discount rate of x percent per year tends to ignore future events as "morally trivial," at least in the situation where decision makers literally "discount lives" by finding that a number of future lives is equivalent to a smaller number of present lives.[143] Parfit postulates a scenario in which nuclear waste causes one billion deaths in 500 years. At a discount rate of only 5%, those deaths are equivalent to a single death today. Thus, if we would not be willing to expend the resources necessary to avoid one death today, discounting suggests that we should be similarly unwilling to spend that sum, even though the benefit would instead be the certain saving of one billion deaths in 500 years. For Parfit, discounting in this manner suggests that the moral significance of these future deaths has declined, a conclusion he deems unjustifiable.

Parfit concludes that the opportunity cost explanation for discounting does not justify the use of the procedure. He posits a case in which benefits would be consumed, rather than reinvested, e.g., the natural beauty of the countryside that would be destroyed by construction of a proposed airport.[144] In Parfit's view, future generations do not receive any increased value from a reinvestment of the current generation's appreciation of the countryside. Thus, the future's enjoyment of the view cannot be discounted to reflect any present value.

---

140 The debate about this attitude is evidenced in a dialogue between a geologist who wishes to mine in the Cascade Mountains and a conservationist who wishes to preserve them, as recounted in J. McPhee, Encounters with the Archdruid: Narratives About a Conservationist and Three of His Natural Enemies 74 (1971):

> "The future can take care of itself," Park said. "I don't condone waste, but I am not willing to penalize present people. I say they're penalized if they don't have enough copper. Dave says they're penalized if they don't have enough wilderness."

Implicit in this statement is the important lesson that all courses of action impose costs. The issue then, is not cost avoidance, but cost optimization.

141 See Golding, Obligations to Future Generations, 56 Monist 97 (1972). But see Kavka, The Futurity Problem, in R. Sikora & B. Barry, Obligations to Future Generations 186, 189-92 (1978).

142 See e.g., Krieger, What's Wrong with Plastic Trees?, 179 Science 446 (1973).

143 See D. Parfit, supra note 115, at 357.

144 Id. at 483.

This is not to say that Parfit believes that future benefits must always be weighed against current costs as if the two were contemporaneous. Instead, he argues that:

> conclusions that are established by such (opportunity cost) calculations could be re-expressed in a temporally neutral way. When describing the effects of future policies, economists could state what future benefits and costs there would be, at different times, in a way that used no discount rate. The arguments that appeal to opportunity costs could be stated in those terms.[145]

Parfit's suggestion is somewhat confusing. It is unclear whether he is permitting decision makers to consider at all the issue of when the costs and benefits of a policy will materialize. Further, his conception of a "temporally neutral" decision ignores the fact that while discounting favors present benefits over future ones, failure to discount does just the opposite. "Neutrality" in this situation seems rather fictitious. At a minimum, however, Parfit seems concerned that formal calculations of a discount rate and current valuations of future benefits will interfere with, rather than assist, intuitive judgments concerning alternative policies. Even here, though, intuitions are not unidirectional. Substantial writing suggests that we have obligations to those with whom we are in a special relationship that exceeds our obligations to strangers.[146] As a legal matter, some special relationships trigger obligations not present to the public at large.[147] The temporal extension of this view would hold that we have obligations to those who currently exist that do not necessarily extend to those yet to be born.

In a vein similar to Parfit, Peter Railton has argued that discounting produces perverse effects insofar as it favors policies that produce short-term benefits while imposing long-term costs.[148] Railton's argument is a direct attack on those who, apart from discounting, contend that it is sensible to impose costs, e.g., environmental harms, on future generations because they are likely to possess technological advances necessary to bearing those costs. Railton argues instead that caution is appropriate when considering future effects -- particularly in the environmental area -- because "(i)t is . . . almost always easier to do than to undo ecological damage."

Railton attempts to demonstrate the perversity of discounting by postulating two policies, A and B. The former will save 8 "present" lives while causing 12 "surplus" deaths in 15 years. The latter has only future effects: it will save the lives of 14, and cause the death of 12, both in 15 years. Railton suggests that discounting would favor the former policy, notwithstanding that it causes more "actual" deaths than it saves, because (assuming a discount rate in which money doubles every 15 years) the 8 current lives have a dollar equivalent of 16 lives when the costs materialize. (Railton's argument is couched largely in terms of the propriety of monetizing human life, an approach that he implies necessarily entails some use of human capital evaluations. As we find that approach inappropriate, but unnecessary, we couch his argument in more generic terms of numbers of lives). He seconds Parfit's view that discounting provides little basis for deferring adverse effects that have no economic value and, thus, cannot appreciate: "the gain in happiness to a family

---

145 Id. at 484.

146 See Anderson, Values, Risks, and Market Norms, 17 Phil. & Pub. Aff. 54, 58 (1988); Fried, supra note 71.

147 See, e.g., Tarasoff v. Regents of University of California, 17 Cal.3d 425, 551 P.2d 334, 131 Cal. Rptr. 14 (1976).

148 See Railton, The Search for a Single Metric (unpublished manuscript 1987).

that does not lose a beloved member in, say 1987, will not compound at a social rate of interest to become an amount of well-being large enough to offset the bereavement of two families, each of whom loses a beloved member in 2002."[149]

The lesson learned from this critique is not that discounting is always inappropriate. Both Parfit and Railton suggest that discounting may be useful, as when there exist predictable technological improvements that will render future generations better able to deal with costs while still enjoying benefits conferred by the present. Rather, the appeal of the critique lies in its implicit rejection of a unitary conception of societal assets. Some assets increase in value over time and are thus susceptible to discounting. Others, however, may be so idiosyncratic, irreplaceable, or external to market transactions that they are less vulnerable to the arguments (compounding interest and opportunity costs) that underlie discounting. The important regulatory implication, therefore, is that a uniform approach to the issue of discounting may not be suitable; some analysis will first be needed of the types of future costs and benefits and their susceptibility to intertemporal comparisons.

3. OMB Discounting Guidance and Agency Practice.

In 1972, the Office of Management and Budget issued Circular No. A-94 to establish a common discount rate for use throughout government, except where statutes prescribed alternative rates. OMB selected a rate of 10%, which remains unchanged, as "an estimate of the average rate of return on private investment, before taxes and after inflation".[150]

While much discussion has ensued over the years about the suitability of this rate, a topic we take up in the next section, OMB has continued to urge use of the 10% rate in agency analyses of both the costs and benefits of regulations, as well as of other agency programs. However, since 1981, OMB has taken the position that any agency should feel free to supplement use of the 10% rate with analysis showing the sensitivity of the outcomes to selection of any other rates the agency thinks applicable.[151]

Moreover, in the 1987-88 edition of the Regulatory Program of the United States,[152] OMB's discussion of discounting practices and objectives calls attention in non-judgmental fashion to cases in which agencies have relied on rates other than 10%, and OMB is silent on whether use of that figure continues to be desirable. Indeed, in our discussions OMB staff indicated that, in light of work done by Lind and others, 10% is not always the best choice.

Whatever the particular discount rate selected, OMB has argued consistently that the same rate should be applied to benefits and to costs. This normally involves computing the present values of each (although OMB points out that alternatively agencies can annualize the benefit and cost streams over the same time frame).[153] Nonetheless, agencies not infrequently depart from this practice, declining to apply discounting to future benefits at all, or using a lower discount rate for benefits.

---

149 Id. at 37.

150 Circular No. A-94 at 4.

151 See OMB's Interim Regulatory Impact Analysis Guidance.

152 See OMB, supra note 5, at xxi.

153 Id. at xxii.

The Regulatory Program cites two OSHA rulemakings (for asbestos and ethylene oxide) where the agency applied a 10% discount rate to costs but did not discount benefits at all, and another EPA rulemaking (for lead phasedown) where discounting occurred at a three percent rate.[154] By contrast, EPA, in its December 1986 analysis of drinking water lead risks, used a five percent discount rate for benefits from reducing lead in drinking water, while adhering to the 10% rate for costs.[155] At NHTSA, the preferred discount rate is seven percent,[156] although its parent Department of Transportation suggests that all parts of the department should be complying with the OMB prescribed rate.[157] Actual discounting practices are indeed diverse.

4. Choosing the Discount Rate.

As noted in earlier sections, discounting may not always be suitable in evaluating fatality reduction benefits. But where discounting is desirable, the question remains of how best to choose the rate. Little agreement exists about the proper number or even about the correct methodology for finding the number. Under these circumstances, sensitivity analysis is particularly inviting. The idea is to show how much the results would differ by switching to alternative discount rates. Then, if the regulation looks appealing for a range of discount rates, it matters little which rate is optimal, and the discount rate choice can be side-stepped.

One obvious starting point for discount rate choice is OMB's current guidance. As noted above, OMB based its choice on the rate of return available on private investment. The logic is that a government project (or mandated expenditure for regulatory compliance) draws funds away from private investment projects, depriving society of the related productive activity. The pre-tax rate of return then is relevant, because society also experiences a loss of tax revenues if the capital investment is not made. Thus the discount rate is chosen to reflect the real opportunity cost of capital, and as such a 10% rate is not unreasonable. Indeed, some have suggested a rate anywhere in the range of 10 to 25% could be justified.[158]

However, the costs of regulation may take various forms, forgone capital investment being only one. In particular, the costs may show up as reduced consumption (through higher consumer product prices). Then a different conceptual framework is needed, and much work has been done in recent years to develop a suitable one.[159] To the extent that the compliance cost takes the form of reduced consumption, the regulation should be evaluated in terms of how people value a loss of present consumption. This we can accomplish by identifying the interest rate level high enough to induce people to postpone consumption, i.e., to save. While one can debate the precise number for this interest rate, often termed the "social rate of time preference," certainly the range is considerably lower than that for capital rates of return.[160]

---

154 Id. at xvii.

155 EPA, Reducing Lead in Drinking Water: A Benefit Analysis, III-58, IV-49.

156 The Economic Cost to Society of Motor Vehicle Accidents at V-4.

157 See DOT, Guidance for Regulatory Evaluations: A Handbook for DOT Benefit-Cost Analysis at 17.

158 R. Tresch, Public Finance: A Normative Theory (1981).

159 See Bradford, Constraints on Government Investment Opportunities and the Choice of the Discount Rate, Am. Econ. Rev. 887 (1975); Lind, Discounting for Time and Risk in Energy Policy (1982).

160 Tresch puts the range at 3 to 6 percent for the social rate.

The most promising discounting framework now appears to be one which in essence combines these two approaches, recognizing that both investment and consumption may decline near-term when regulation is imposed. The intent is to identify the portion of compliance cost that does displace private investment and then to translate that displacement into a corresponding forgone future stream of consumption -- consumption that will not take place because the capital investment necessary to generate it never took place. These "consumption-equivalent" costs of the regulation then can be added to the compliance costs that do not come at the expense of investment (that is, costs born by consumers right from the start). All costs thus can be portrayed as lost consumption, some now and some later. The final step then is to utilize the social rate of time preference as the discount rate in computing the present value of this stream of future effects.[161]

This falls short of providing a firm answer to the question of "What number?," in part because the most satisfactory approach conceptually (the framework just discussed) is not easy to apply empirically. But most would agree that 10% is too high a rate.

IV. Recommendations

The foregoing discussion leads us to recommend a series of measures for agency regulations that affect human life. Our recommendations are predicated on the belief that the uncertainties underlying valuations of human life provide agencies with substantial discretion in justifying decisions to implement or reject proposed regulations based on factors only tangentially related to the relative benefits that would be conferred through regulation. We are not suggesting that agencies have failed to adopt more precise measures that would improve the quality of their life valuations. To the contrary, we recognize that given the embryonic state of knowledge on this issue, both methodologies and results are likely to vary across agencies. Additionally, we are sensitive to arguments that lives should be valued differently in different contexts. In this environment, however, we believe it would be useful for agencies to take measures that would reveal publicly the processes through which they have determined the valuation of life incorporated in policy decisions. In this way, agency practice can be measured against developments in the valuation area and evaluated for consistency with other agencies and other regulations in the same agency. Most importantly, full disclosure of agency practices provides the best way to hold agencies accountable for selecting a particular set of variables for consideration and excluding others. Toward these ends, we recommend the following procedures.

1. Agencies that adopt regulations substantially on the justification that reduction of risk to human lives warrants incurring the associated implementation and compliance costs should state an explicit valuation utilized, or should disclose the cost per statistical life saved implicit in that determination. Such a procedure will provide useful clarification and exposition of the unavoidable tradeoffs involved in regulating hazards and assist in drawing attention to those hazards where further protection may be feasible at acceptable cost. This is not to say that decisions about relative costs and benefits of a proposed regulation cannot be trumped by other variables. We believe, however, that the explicit values used by an agency is a relevant datum to be used by political decision makers in determining whether to employ those trumps. Exceptions to this principle might exist where empirical information about either the regulation's costs or benefits is highly conjectural or where the

---

161 Fuller discussions of this approach appear in Lind, supra note 149; Staiger & Richardson, A Discounting Framework for Regulatory Impact Analysis, 18 Policy Sciences 33; EPA, Guidelines for Performing Regulatory Impact Analysis, Appendix C.That the same rate should be applied to benefits as to costs is discussed in DOT, 1 Methods for Economic Assessment of Transportation Industry Regulations III-17.

benefits include a variety of non-market improvements where monetizable benefits are not obvious, e.g., aesthetic gains. In such cases, efforts to characterize accurately the imprecision of the valuation process may minimize the perception of substantial certainty.

2. We believe that continued use of willingness-to-pay methodology to place value on human life requires more attention to the limitations of that approach. While willingness-to-pay provides the most inclusive analysis currently available for evaluating the benefits derived from regulatory reduction of fatalities, it falls far short of an ideal process and can produce results that are misleading for failure to consider all variables relevant to an inclusive valuation process. While current willingness-to-pay investigations incorporate factors not considered in alternative methodologies, they cannot satisfactorily account for informational disabilities or cognitive error in the respondent population. We recommend, therefore, that any valuation of life, whether based on willingness-to-pay or an alternative methodology, be accompanied by a statement of variables that the agency believes to have been slighted or omitted from consideration but that would affect (positively or negatively) the explicit values derived. The agency should also explain how it takes account of any such additional factors.

3. OMB'S Circular A-94 concerning the use of a discount rate should be revised to reflect learning on the subject since the time of its promulgation. We do not endorse the adoption of a specific discount rate. Rather, we recommend that a revised Circular articulate the various methods by which a discount rate can be derived and the scope of subjects to which it can be applied. However agencies choose to discount costs and benefits, they should clearly and fully disclose what rates they are using, the methodology that generated those rates, and the sensitivity of outcomes to the particular rates applied.

4. While uniform practices in the life valuation area may not be warranted (because of the diversity of hazard situations, as well as the inconclusive nature of much of the empirical information on which decisions are based), there is justification for greater interchange of information among agencies on how decisions are made and utilized in this contentious area. Thus, we recommend the creation of a central clearing house for research on valuation issues. To this end, we suggest that OMB expand its discussion of agency practices, initiated in the 1987-88 volume of the annual Regulatory Program and make such discussion a standard practice.