EQUIVALENT FRAMES OF REFERENCE FOR JUDGING RISK REGULATION POLICIES

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INTRODUCTION

For most economists, the appropriate test for evaluating risk regulation policies is the same as that used in evaluating policies in other contexts: whether the benefits of the policy exceed the costs.[1] In the case of risk regulation, the value of the benefits of a policy consists of the statistical lives saved as a result of the policy, weighted by society's willingness to pay for the reduction in risk, the statistical value of life. These benefits must be measured against the costs of the policy. More than a decade of economic research has been directed at refining the value of a statistical life for purposes of measuring the benefits of a risk regulation policy against its costs.[2]

Despite the apparently straightforward nature of this benefit-cost approach, this basic economic test for risk regulation remains controversial. Most risk regulation agencies have legislative mandates that prohibit basing policies on benefit-cost tests. Instead, policy objectives tend to be more narrowly de-

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1 *See generally* EDITH STOKEY & RICHARD J. ZECKHAUSER, A PRIMER FOR POLICY ANALYSIS (1978) (discussing the principles of benefit-cost analysis and policy analysis).

2 *See, e.g.*, John Garen, *Compensating Wage Differentials and the Endogeneity of Job Riskiness*, 70 REV. ECON. & STAT. 9 (1988); Craig A. Olson, *An Analysis of Wage Differentials Received by Workers on Dangerous Jobs*, 16 J. HUM. RESOURCES 167 (1981); *see also* W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK 51-74 (1992) [hereinafter FATAL TRADEOFFS] (reviewing statistical life research); W. Kip Viscusi, *The Value of Risks to Life and Health*, 31 J. ECON. LITERATURE 1912, 1912-46 (1993) [hereinafter *Value of Risks*] (reviewing similar research).

fined. For example, the intent of a policy may be restricted to achieving a reasonable degree of risk reduction.[3]

Even in situations in which detailed economic assessments are carried out, government agencies are understandably reluctant to attach an explicit value to human life. What price per life will appear to be defensible to the general public? Although the administrative process for the issuance of new regulations often includes an assessment of the benefits of saving lives, there has been very little public debate over the dollar value that should be attached to each statistical life which will be saved through government action.[4]

In *Breaking the Vicious Circle: Toward Effective Risk Regulation*, Justice Stephen Breyer shares this reluctance to endorse a specific value of human life.[5] Breyer recasts the traditional economic test in two ways that avoid an assessment of the value of life. First, Breyer utilizes a personal choice reference point for automobile safety that allows a comparison of the reasonableness of various risk reduction efforts in public contexts with the reasonableness of such efforts in private contexts.[6] This cost-effectiveness method examines only the cost of a regulatory policy and the hypothetical number of lives saved. Second, Breyer sets forth a risk magnitude test that looks solely at the hypothetical

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[3] *See, e.g.*, Occupational Safety and Health Act of 1970 § 6(b)(5), 29 U.S.C. § 655(b)(5) (1988); American Textile Mfrs. Inst., Inc. v. Donovan, 452 U.S. 490, 509 (1981) (finding explicitly that benefit-cost tests should be ruled out); Industrial Union Dep't, AFL-CIO v. American Petroleum Inst., 448 U.S. 607, 639-42, 653 (1980) (concluding that the agency had to address significant risks of harm and issue standards that were "reasonably necessary or appropriate" to promote safety and health and that the Secretary must find "on the basis of substantial evidence, that it is at least more likely than not that long-term exposure to [the hazard without new regulation] presents a significant risk of material health impairment"); *see also* W. KIP VISCUSI, RISK BY CHOICE: REGULATING HEALTH AND SAFETY IN THE WORKPLACE 16 (1983) [hereinafter RISK BY CHOICE] (discussing the limited role of benefit-cost tests in job safety regulations); FATAL TRADEOFFS, *supra* note 2, at 250 (discussing appropriate balancing of benefits and costs of policies).

[4] Perhaps the greatest exception to this absence of a public debate over the value of life was the recent controversy over the linkage between regulatory expenditures and mortality. In particular, what level of regulatory expenditures will lead to the loss of a statistical life because society has been made poorer because of the expenditures? This question, which is analytically distinct from the value of life from the standpoint of risk regulation, will be explored further below.

[5] STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION (1993).

[6] *Id.* at 67.

number of lives saved.[7] This method also utilizes comparison, this time in the form of examining a risk ladder, the focus of which is cigarette smoking risks.

This Article examines the extent to which assessments of risk policies that utilize only a portion of the elements of the benefit-cost analysis can generate the same outcomes as would result from a comprehensive benefit-cost assessment. Would the partial tests proffered by Justice Breyer offer a mechanism for screening out the very worst risk regulations but not be fully informative in eliminating all undesirable policies? Alternatively, would such partial perspectives on policy attractiveness be misleading in some instances but provide correct guidance in others? Finally, could Justice Breyer's approaches be no different fundamentally from that of the standard economic formulation? Perhaps he has simply recast our frame of reference for examining risk regulation questions in a manner that would lead to the same policy prescription as would the standard economic test, while avoiding some of the sensitivities embodied in public discussions of the value of human lives.

Part I of this Article formulates in detail the standard benefit-cost approach to policy evaluation in the risk reduction context. The Part extensively examines the economic technique for valuing human life and the issues that affect the acceptance of the benefit-cost test. Parts II and III examine the two alternative perspectives developed by Justice Breyer: (1) a comparison of the cost effectiveness of reducing risk in public and private contexts, utilizing automobile safety as a personal choice reference point; and (2) a comparison of the relative magnitude of various risks, utilizing the placement of cigarette smoking on a risk ladder. Each of these Parts explores how the alternative perspective relates to the basic benefit-cost approach of economists to determine whether these partial assessments measure up to the comprehensive benefit-cost analysis.

I

Benefit-Cost Analysis

The principal economic test for measuring the attractiveness of any policy option is whether, on balance, the policy option is in

[7] *Id.* at 65.

society's best interests.[8] More specifically, do the benefits society derives from the effort exceed its costs? In the context of risk reduction policies that are expected to save statistical lives, the following test is used to determine whether a policy is economically reasonable:

[Lives Saved][Value of Life] > Cost[9] (1)

The following section analyzes the three components of this equation: statistical lives saved, the cost of risk reduction, and the value per life saved. Finally, this section explores the place of the benefit-cost analysis in the political arena.

A. *Statistical Lives Saved*

First, Equation 1 requires the determination of the total number of statistical lives saved by the policy. To make this determination, one must examine the magnitude of the risk and the magnitude of the population exposed to the risk both with and without a proposed policy. One should also consider discounting the hypothetical number of lives saved or adjusting the hypothetical number of lives saved for the quality of the lives that are being saved.

1. *Magnitude of the Risk*

The magnitude of the risk means the chance that any person in a population will be affected by that risk. Is there, for example, a one in a million chance of cancer that is being reduced, or is it a much more substantial risk? Additionally, one must assess how many people are affected by the risk. The hypothetical number of lives affected by a risk is then calculated by multiplying the magnitude of the risk by the total number of persons affected by the risk. The difference between the number of lives affected without a certain risk reduction policy and the number of lives affected with such a policy yields the number of statistical lives saved by the selected policy.

Of course, quantifying the magnitude of a risk in this manner is not without controversy. In particular, many of the scientific aspects of the analysis are in dispute.[10] Consider, for

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[8] *See* STOKEY & ZECKHAUSER, *supra* note 1.

[9] This equation will be referred to throughout as Equation 1.

[10] *See generally* PHANTOM RISK: SCIENTIFIC INFERENCE AND THE LAW (Kenneth R. Foster et al. eds., 1993) (exploring many of the scientific disputes).

example, the risk assessments undertaken to justify the cleanup of prospective Superfund sites. In its analysis of the desirability of cleanup, the United States Environmental Protection Agency (EPA) assesses the different mechanisms associated with the risks at each site.[11] However, embodied in these estimates is a series of conservative assumptions that influence the ultimate estimate. The main factor affecting these biases is that EPA does not utilize the average exposure amount or the mean risk associated with any chemical. Rather, the emphasis is on developing a conservative estimate of the risk which, for the different components, often involves utilization of the upper bound of the 95% confidence interval around the risk. Thus, in the case of chemical exposure amounts, for example, the exposure level used for the risk assessment is typically the upper bound of the exposure distribution. In other words, the probability that the exposure level is likely to exceed the actual exposure amount is only .025.[12] The net effect of these various conservative assumptions is unclear, but the character of the risk assessment process generally results in an over-assessment of the expected risks because of the emphasis on conservative, or worst-case, scenarios.

These types of biases can potentially distort risk regulation policy-making.[13] The degree that conservatism biases policies may vary from context to context. Ideally, we would like to know that a one in a million risk from food additives is just as serious as a one in a million risk from adverse reactions to a pharmaceutical or a one in a million risk from job hazard exposures. However, if the risk assessment procedures and the biases incorporated in these procedures differ from agency to agency and from substance to substance, then meaningful comparisons cannot be made. This Article assumes that society's objective is to save the greatest number of lives for any given expenditure.

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11 This exercise leads, for example, to results such as an estimated 1/10,000 lifetime risk of cancer from groundwater contamination. *See* James T. Hamilton & W. Kip Viscusi, *Human Health Risk Assessments for Superfund*, 21 ECOLOGY L.Q. 573, 585 (1994).

12 These types of conservative adjustments affect a variety of components of the risk assessment. In the case of groundwater ingestion, the upper bound of the confidence limit is utilized for the ingestion rate, the exposure frequency, the exposure duration, the chemical concentration, and the toxicity level. *Id.*

13 Albert L. Nichols & Richard J. Zeckhauser, *The Perils of Prudence: How Conservative Risk Assessments Distort Regulation*, REG., Nov.-Dec. 1986, at 13, 13-24. *See* W. Kip Viscusi & Richard J. Zeckhauser, *Risk Within Reason*, 248 SCI. 559, 562 (1990).

To accomplish this goal, society must have accurate assessments of the actual risks and not distort risk assessments by incorporating conservative adjustment factors of unknown and inconsistent magnitude into the risk assessment process.

2. *Magnitude of the Population Exposed*

There has also been some controversy in assessing the magnitude of the populations exposed to a risk. Generally, if concern is centered on the expected number of lives that will be saved by the regulation, then one clearly must move beyond an assessment of probabilities and consider the actual size or magnitude of the populations exposed as well.[14] However, in many cases, this aspect of the risk assessment is not examined because the focus is on the probabilities. For instance, in the case of Superfund sites, EPA does not match the risk pathways to surrounding populations to estimate the expected cancer cases for the populations at risk.[15] In some cases it could be possible that the risk is only present at the Superfund site itself. Consequently, risks associated with such sites could be prevented by capping and fencing sites and by imposing appropriate deed restrictions to prevent people from building houses on the sites in the future.

3. *Discounting Hypothetical Lives Saved*

In addition to assessing the probabilities involved and the populations affected, further refinements in calculating hypothetical lives saved are possible through discounting. For example, if lives saved by a policy would be saved decades from now, rather than immediately, such lives should be discounted (i.e., receive a lower weight) to take the timing into account. Suppose, for example, policy A saves five expected lives now and policy B saves five expected lives ten years from now. Each policy costs $15 million. Are these efforts equally attractive? Policy A is clearly

[14] The discussion below will indicate that in many instances, examining the risk probability is instructive, but one should not lose sight of the importance of also taking into account the degree of exposure. *See infra* part III.

[15] What EPA does do is distinguish the different classes of population groups affected by the risk rather than the total number of people affected by each risk pathway. In research funded by EPA, James T. Hamilton and I are matching the EPA risk data to U.S. Census population data at the block level in an effort to establish an estimate of the expected number of cancer cases that will arise because of the Superfund hazards.

more attractive because it saves five lives now for a cost at the time the lives are saved of $15 million. In contrast, policy B saves the five lives a decade from now, but the cost at the time the lives are saved is the $15 million invested this year plus any accrued interest over the next decade on this investment. Therefore, the cost per life saved during the year that lives are being saved will be greater for policy B.[16] Reversing this logic, lives saved in the future should be discounted to take into account the lower value such lives have when compared with lives currently saved.

This discounting distinction is not a mere economic refinement. In fact, discounting was an issue of paramount concern in the case of the debate over the asbestos regulation between EPA and the United States Office of Management and Budget (OMB). Because of the substantial time lag before the asbestos reduction benefits would occur, discounting the benefits would substantially reduce their value and the relative attractiveness of the regulation. For example, using the OMB-recommended discount rate of 10%, and assuming a twenty-year lag before the cancer reductions from asbestos removal took effect, the net influence of the discounting would be to make the value of these risk reduction benefits less than 15% of what they would otherwise have been. At more reasonable discount rates, such as a real rate of interest of 5%, benefits would be 38% of what they would have been, and at a 3% rate, benefits would be 55% of what they would have been. Because of the substantial effect of discounting based on the choice of interest rate, EPA advocated that the benefits of the proposed regulation should not be discounted so that the apparent attractiveness of the regulation is not diminished. In contrast, OMB advocated discounting, which would have led to less stringent regulation.[17]

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16 For example, if the interest rate is five percent, where this interest is net of inflation, then the cost at the time the five lives will be saved a decade from now will be $24.4 million, including the value of the accrued interest. The present value calculation that simply discounts the expected number of lives saved rather than converting the current allocations into their future value including interest leads to the same policy perspective.

17 *See* U.S. OFFICE OF MANAGEMENT & BUDGET, REGULATORY PROGRAM OF THE UNITED STATES GOVERNMENT, APRIL 1, 1988-MARCH 31, 1989, at 35-37 (1988) [hereinafter 1988-89 REGULATORY PROGRAM] (stating that OMB advocates discounting in general).

4. *Adjustments for the Quality of Lives Saved*

A second refinement pertains to recognition of the quantity and the quality of lives saved by a policy. Risk reduction efforts do not literally save lives; they extend lives. Therefore, the nature of the lives that will be extended as a result of risk reduction policies is an important issue. For instance, decreasing sulfur oxide emissions will primarily eliminate respiratory ailments among the very senior members of the population and reduce their associated mortality.[18] In contrast, improved automobile safety will affect a much wider age range of the population. Distinctions based on age raise questions as to whether adjustments should be made to the hypothetical number of lives saved based upon quality of life.

Should life-saving efforts that affect individuals with relatively little life left to live receive the same value as those that benefit people with a much greater life expectancy? Saving a person's life from a risk of death at age twenty-two surely has a greater value than saving that person's life from some other risk of death at age ninety. Ideally, one would like to make some kind of quantity adjustment to account for the total length of life lost. Although there have been numerous economic discussions of such an approach,[19] government agencies have not yet incorporated this level of refinement into risk regulation policy contexts. To be sure, the overall concept of valuing life remains sufficiently controversial so as to preclude the consideration of an additional layer of controversy concerning distinctions among individuals of different ages.

B. *Costs of Risk Reduction*

The second and perhaps least controversial component of Equation 1 pertains to the costs associated with a risk reduction policy. For the most part, ascertaining regulatory costs is an accounting exercise. One simply examines the types of expenditures required by the regulation and tallies them appropriately.

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[18] JOHN-MARK STENSVAAG, CLEAN AIR ACT: LAW AND PRACTICE § 7.2, at 1 (1991).

[19] Richard J. Zeckhauser & Albert L. Nichols, *The Occupational Safety and Health Administration: Its Goals and Achievements*, *in* THE STUDY OF FEDERAL REGULATION OF THE SENATE COMMITTEE ON GOVERNMENT OPERATIONS 163, 163-248 (1979); *see* FATAL TRADEOFFS, *supra* note 2, at 30-31; *Value of Risks*, *supra* note 2, at 1920-22.

There may, however, be substantial uncertainties involved, particularly in situations in which a regulation would mandate the development of new technologies, the costs of which are uncertain. For instance, if judgments regarding regulatory costs are based on the cost of existing technologies that fail to take into account the cost-reducing influence of technological progress, such estimates will tend to overstate the associated costs of the regulation.

The nature of such biases often cannot be predicted in advance. In the case of the Superfund cleanup efforts, for example, it appears that the costs of cleanup are much greater then EPA originally estimated.[20] The *ex post* analysis of the cost actually incurred with the cotton dust regulations of the Occupational Safety and Health Administration (OSHA) also suggests that the costs were greatly misestimated, as were the benefits.[21] In that case, the errors can be traced to analytical errors in the benefit and cost assessment process. Yet even though there may be errors in estimates of the costs of risk reduction policies, we should not dismiss these policies since our policy task is to make the best policy judgments given the knowledge that is available to us. However, greater efforts to determine the nature and extent of the biases in policy evaluation could improve the accuracy of policy judgments.

Moreover, the determination of actual costs is itself difficult. One complicating factor is that companies may use the technological change required by a regulation to overhaul their technological base, a move that enhances productivity while reducing the associated risk. In the case of the OSHA cotton dust standard, textile mills responded to the regulation by installing new and more efficient technologies that brought about dividends not anticipated in the original cost estimates.[22] However, to the extent that there were beneficial profitability impacts, one would want to net these out in determining the ultimate costs of the regulation. Thus, there exists a general analytical need to under-

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[20] *See Superfund Law Amendment Plans Announced*, HAZNEWS, Apr. 1994, *available in* LEXIS, Envirn Library, Allnws File (citing a 1994 Congressional Budget Office study of Superfund costs).

[21] *See, e.g.*, W. Kip Viscusi & Paul Kolp, *Uncertainty in Risk Analysis: A Retrospective Assessment of the OSHA Cotton Dust Standard*, *in* ADVANCES IN APPLIED MICROECONOMICS 105, 124-27 (V. Kerry Smith ed., 1986).

[22] *Id.* at 116.

take more studies of the monetary costs and benefits of regulations after they take effect.

C. *Value Per Life Saved*

The third and most controversial component of Equation 1 is the value per life saved. From an economic standpoint, however, the value per life saved should not be objectionable. It only represents a description of society's willingness to pay to reduce various risks to life. While the value per life saved does include such economic accounting measures as the calculation of the present value of future earnings, it consists primarily of the benefit of the lifesaving activities to the person affected by these efforts. The value per life saved may also include broader, altruistic concerns as well to the degree that society wishes.

The willingness of society to pay for risk reduction is framed in terms of society's willingness to pay for small reductions in risk, not society's willingness to pay for the elimination of a certain risk of death. By promulgating a governmental risk regulation, society buys a small reduction in some incremental risk of perhaps one in a million per year, not a reduction in our probability of death from 1.0 to 0. A determination cannot be made either prospectively or retrospectively whose lives are saved. Sometimes each member of a very large group of potential beneficiaries faces a comparatively small risk of death. Since the effects are based on probabilities, it may be that, in actuality, no lives will be lost, or it may be that many lives will be affected. The lifesaving effort reduces this probability of death for each of the exposed individuals. The appropriate societal value of this risk reduction is the exposed individuals' willingness to pay for their improved safety, plus any broader willingness to pay on the part of the unaffected segments of society.

To facilitate such calculations, the value of life figure is expressed in unit terms per statistical life. For example, consider a situation in which each of 10,000 individuals faces a 1/10,000 risk of death and is willing to pay $400 to eliminate that risk. What is the pertinent value of a statistical life? For this group of 10,000 people, on average one of them will be killed. Moreover, they would be willing to pay $400 each, multiplied by the 10,000 people, or $4 million to save one statistical life. Thus, in this context, the value of a statistical life is $4 million, or the amount of money that could be raised collectively to prevent the one statistical death to the group's members.

This methodology of establishing the willingness to pay per unit of risk yields the same results as simply dividing the willingness to pay amount (i.e., $400) by the reduced probability of death (i.e., 1/10,000). This latter approach has perhaps less intuitive appeal, but it is equivalent analytically, and it is possibly more flexible where there is not a sufficiently large population affected for there to be one statistical death to provide a basis for discussion.

Most of the evidence pertaining to the value of life is derived from labor market evidence, rather than from surveys that explicitly address society's willingness to pay for reduced risk. In particular, economists have utilized data on worker earnings, personal characteristics, and job characteristics, including safety, and have estimated statistically the wage premium that workers receive in return for facing higher risks on the job.[23] For very small risks of death, such as the average occupational fatality risk of 1/10,000 per year, the amount of money that workers demand to face an added risk is roughly comparable to the value they are willing to spend to reduce the risk level. As a result, the rate at which people demand compensation for small risks should, in theory, provide a good index of how much people are willing to pay for the government to reduce the risk by a small amount. The available evidence from labor studies suggests that most of the wage premium estimates cluster in the range of $300 to $700 per year for the average worker facing the average 1/10,000 risk.[24] As a result, these studies imply that the average value of life is in the range of $3 million to $7 million.

This number is by no means a universal constant. Different workers have different values of life, depending on their attitudes towards risk. Workers who have sorted themselves into high-risk jobs, for example, have comparatively low values of life. These values tend to be in the range of $1 million.[25] Similarly, econo-

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[23] *See, e.g.,* FATAL TRADEOFFS, *supra* note 2, at 51-59; Garen, *supra* note 2, at 12; Olson, *supra* note 2, at 173.

[24] FATAL TRADEOFFS, *supra* note 2, at 73; *see also* Garen, *supra* note 2, at 12 (stating that $4 million is a similar figure to those figures found in other labor studies); Olson, *supra* note 2, at 173 (finding yearly estimated risk premiums to be $350 per year).

[25] Richard Thaler & Sherwin Rosen, *The Value of Saving a Life: Evidence from the Labor Market*, *in* HOUSEHOLD PRODUCTION AND CONSUMPTION 265,

mists have found that cigarette smokers often have comparatively low values of life and attach relatively low values to on-the-job injuries.[26] This behavior is consistent with smokers placing a lower value on their health than the general public, not only in smoking contexts but in other risk-taking contexts as well. Similarly, people who are highly averse to risk may have a value of a statistical life well in excess of $7 million.[27]

Other kinds of safety tradeoffs people make provide another source of evidence on the implicit value of life. For instance, people make a variety of product safety decisions, such as deciding to wear a seat belt, install a smoke detector, or buy a house in a low pollution area. Economists have examined each of these contexts in an effort to attach a value on statistical lives relative to our expenditures on safety. Table 1 summarizes the implicit value of life based on a variety of contexts other than jobs. Specifically, economists have assessed such values based on the added price people are willing to pay for risk reduction measures. For example, if one were willing to pay $30 extra for a smoke detector that reduced one's risk of death from fire by 1/100,000, then one's implicit value of life would be $3 million. The smoke detector studies are the least sophisticated of those listed, as there is very little variation in the price-risk combinations ex-

265-98 (Nester E. Terleckyj ed., 1976) (finding that workers who are in relatively high risk jobs and face an annual death risk of 1/1,000 per year value their lives at about $176,000); *see also* FATAL TRADEOFFS, *supra* note 2, at 42; *Value of Risks*, *supra* note 2, at 1925-28.

[26] *See* Joni Hersch & W. Kip Viscusi, *Cigarette Smoking, Seatbelt Use, and Differences in Wage-Risk Trade-Offs*, 25 J. HUM. RESOURCES 202, 217-21 (1990); Pauline M. Ippolito & Richard A. Ippolito, *Measuring the Value of Life Saving from Consumer Reactions to New Information*, 25 J. PUB. ECON. 53, 66 (1984).

[27] W. Kip Viscusi, *Occupational Safety and Health Regulation: Its Impact and Policy Alternatives*, *in* RESEARCH IN PUBLIC POLICY ANALYSIS AND MANAGEMENT 281, 281-99 (J. Crecine ed., 1981) (finding that workers who were relatively risk averse have an implicit value of life of $6.5 million). The results in the case of nonfatal injuries also indicate the heterogeneity of the value of life. One study shows that smokers have an implicit value of nonfatal job injuries of $30,781, whereas individuals who wear seatbelts have an implicit value of job injuries of $92,245. Seatbelt users are consequently three times as averse to bearing risks as are cigarette smokers. Hersch & Viscusi, *supra* note 26, at 221. There is nothing irrational about being willing to spend over $700 to reduce one's risk of death by 1/10,000. If the risk reductions were very large, budgetary constraints would come into play, but for small risk changes they will not. The $3 million to $7 million range estimates are simply representative figures for groups of workers and by no means bound the value of life numbers that may be pertinent in a particular circumstance.

amined.[28] The assessments based on property value responses to air pollution risks and the linkage between various kinds of automobile risks and implicit value of life are much more sophisticated.[29] In each of these instances, economists have analyzed how prices for safer properties or safer automobiles have responded to the difference in risks embodied in these areas. It is noteworthy that the implicit values of life obtained in the two recent studies of automobile accident risks and the price response have yielded estimates very similar to those obtained from labor market choices.[30] In the case of automobile safety, the evidence suggests that the implicit value of a statistical life is in the range of $3 million to $4 million, based on the added price consumers are willing to pay for safer cars.[31] This similarity is to be expected. If one is acting rationally in allocating one's resources across different domains of choice, we would ideally like to vary the risk levels in these different domains to achieve the same risk reduction per dollar expended in all the different areas of choice available. As a consequence, the consistency between the value of life estimates for automobile safety and the estimates obtained in the labor market provides at least some indication that private risk-taking decisions have some component of rationality.

[28] Rachel Dardis, *The Value of Life: New Evidence from the Marketplace*, 70 J. ENVTL. ECON. & MGMT. 1077 (1980); Christopher Garbacz, *Smoke Detector Effectiveness and the Value of Saving a Life*, ECON. LETTERS, Dec. 1986, at 281, 281-86.

[29] *See* Paul R. Portney, *Housing Prices, Health Effects, and Valuing Reductions in Risk of Death*, 8 J. ENVTL. ECON. & MGMT. 72 (1981); *see also* Scott E. Atkinson & Robert Halvorsen, *The Valuation of Risks to Life: Evidence from the Market for Automobiles*, 72 REV. ECON. & STAT. 133, 133-36 (1990); Mark K. Dreyfus & W. Kip Viscusi, *Rates of Time Preference and Consumer Valuations of Automobile Safety and Fuel Efficiency*, J. L. & ECON. (forthcoming 1995).

[30] *Compare* Garen, *supra* note 2, at 12 (labor market study arriving at an estimated value of life of $4.0 million) *with* Atkinson & Halvorsen, *supra* note 29, at 135 (automobile accident risk study finding an estimated value of life of $3.357 million) *and* Dreyfus & Viscusi, *supra* note 29, at 25 (automobile consumer studies arriving at value of life estimates of between $2.6 million and $3.7 million).

[31] Atkinson & Halvorsen, *supra* note 29, at 135; Dreyfus & Viscusi, *supra* note 29, at 25.

TABLE 1*

Summary of Value of Life Studies Based on Tradeoffs Outside the Labor Market

AUTHOR (YEAR)	NATURE OF RISK	IMPLICIT VALUE OF LIFE (MILLIONS OF 1990 $s)
Ghosh, Lees, and Seal (1975)	Highway speed/value of time tradeoff, 1973	0.07
Blomquist (1979)	Automobile death risks/seat belt use, 1972	1.2
Dardis (1980)	Smoke detector risk reduction, 1974-1979	0.6
Portney (1981)	Property value response to air pollution risk, 1978	0.8
Ippolito and Ippolito (1984)	Cigarette smoking cessation, 1980	0.7
Garbacz (1987)	Smoke detector risk reduction, 1968-1985	2.0
Atkinson and Halvorsen (1990)	Automobile accident risks/price tradeoff, 1986	4.0
Dreyfus and Viscusi (1994)	Automobile accident risk/price tradeoff	2.9-4.1

*FATAL TRADEOFFS, *supra* note 2, at 66 (citing Atkinson & Halvorsen, *supra* note 29, at 133-136; Glenn Blomquist, *Value of Life Saving: Implications of Consumption Activity*, 87 J. POL. ECON. 540-58 (1979); Dardis, *supra* note 28, at 1077-82; Dreyfus & Viscusi, *supra* note 29, at 2; Garbacz, *supra* note 28, at 281-286; Debapriya Ghosh et al., *Optimal Motorway Speed and Some Valuations of Time and Life*, 43 MANCHESTER SCHOOL OF ECON. & SOC. STUDIES 134, 134-43 (1975); Ippolito & Ippolito, *supra* note 26, at 53-81; Portney, *supra* note 29, at 72-78).

Another approach to valuing life utilizes survey questions in ascertaining people's willingness to pay for improved safety. Surveys have been used in a wide variety of contexts, most frequently for motor vehicle accidents. Resulting estimates have yielded value of life figures comparable to those obtained using labor market evidence.[32] The disadvantage of using survey evidence is that the stated willingness to pay for hypothetical reductions in risk may not coincide with the tradeoffs people will make when actually confronted with the risk. The potential advantage of surveys is that the scope of inquiry may be extended to examine other kinds of deaths that might have a different value from acute on-the-job accidents or motor vehicle deaths. For example, researchers have utilized surveys to examine the value of reducing deaths from cancer as well as a wide variety of other outcomes such as chronic bronchitis, temporary poisonings, and illnesses, such as the common cold.[33]

Justice Breyer does not select a particular value of life number based on any of these approaches, though he is sensitive to the importance of this class of concerns. He writes:

> At this point, you may interrupt with a few questions: "Who is to say whether $1 million, or $10 million, or $240 million, or $10 billion, is too much, or too little, to spend to save eight or eighteen or eighty statistical lives? Who can value a human life?"
>
> I cannot answer these questions except by pointing out that, every day, each of us implicitly evaluates risks to life. We begin to run risks to achieve our daily objectives the instant we get out of bed. We find it worth spending money on an ordinary fire alarm system, but not worth installing state-of-the-art automatic-phone-dialing fire protection. We believe it worth installing guard rails on bridges, but not worth coating the Grand Canyon in soft plastic to catch those who might fall over the edge.[34]

Likewise, government agencies have been reluctant to endorse a specific value of life number.[35] The need to make a dollar estimate rather than to simply endorse a general concept may

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[32] *See* FATAL TRADEOFFS, *supra* note 2, at 69; M.W. JONES-LEE, THE VALUE OF LIFE: AN ECONOMIC ANALYSIS (1989).

[33] *See* FATAL TRADEOFFS, *supra* note 2, at 71-72; *see also* Mark C. Berger et al., *Valuing Changes in Health Risks: A Comparison of Alternative Measures*, 53 S. ECON. J. 967 (1987) (surveying 119 people to determine the value to them of reducing the risk of minor ailments); W. Kip Viscusi et al., *Pricing Environmental Health Risks: Survey Assessments of Risk-Risk and Risk-Dollar Trade-Offs for Chronic Bronchitis*, 201 J. ENVTL. ECON. & MGMT. 32 (1991) (surveying 389 people to measure the value to them of reducing the risk of contracting chronic bronchitis).

[34] BREYER, *supra* note 5, at 15-16.

[35] *See generally* Ted R. Miller, *Public Policy Willingness to Pay Comes of Age: Will the System Survive?*, 83 NW. U. L. REV. 876 (1989) (citing a disclaimer

have contributed to the failure of government agencies to explicitly adopt this approach which utilizes a specific value of life, until long after the economic literature on this concept had resolved the principal issues at stake. The pivotal event that led to the initial use of the value of life methodology was not the realization that the economic reasoning was compelling but a realization that proper valuation of human life may make legitimate risk regulations appear more attractive than they would otherwise be.[36]

In its analysis of the hazard communication regulation, for example, OSHA did not assign a value of life to the lives that would be saved through improved chemical safety. Doing so, in their view, would be too sensitive. Instead, OSHA assessed the costs of death for the affected workers based on the present value of the future earnings of the workers whose lives would be saved. The regulatory analysis incorporating this measure was rejected by OMB because the calculated benefits were not in excess of the costs. After an appeal of the OMB decision to then Vice President Bush, who was in charge of resolving regulatory disputes, OSHA and OMB considered an analysis I had prepared using the value of life methodology, rather than the present value of lost earnings. This approach increased the benefit value by a factor of ten, leading the benefits to exceed the costs and providing the analytical impetus for issuance of the regulation shortly after the Reagan White House received the analysis.[37]

Largely because of the substantial magnitude of reasonable value of life numbers, which are in the millions, the benefit assessments based on a proper assessment procedure often enhance the political prospects of regulations. Indeed, a sound regulation should pass such a properly formulated benefit-cost test. As evidenced by the OSHA example, once regulators realize that the economic value of life is not an accounting measure but instead an expression of societal willingness to pay for reduc-

by the National Highway Traffic Safety Administration that the agency's policy is opposed to placing a dollar value on human life).

[36] *See* FATAL TRADEOFFS, *supra* note 2, at 263 (discussing new importance of risk-dollar tradeoffs in the context of the debate over the OSHA hazard communication regulation); Pete Earley, *What's a Life Worth?: Under the Reagan Administration, It May Be Less Than You Thought*, WASH. POST, June 9, 1985, (Magazine), at 10-13, 36-41 (reviewing the debate over the OSHA hazard communication regulation).

[37] Earley, *supra* note 36, at 36.

ing small risks to life, the possibility of using these numbers increases dramatically.

At present, OMB recommends that agencies prepare value of life calculations along the lines outlined above.[38] All major risk regulation agencies undertake such calculations, although the value of life is not uniform across different agencies.[39] There is no reason to impose a uniformity requirement even within a particular agency, as the value of life is not a natural constant and varies depending upon the particular context. For example, the United States Department of Transportation should want to place a higher value of life on the well-being of the lives of airline passengers than those killed in motor-vehicle crashes because the airline passengers have a higher income.[40] Although the Department of Transportation has not made such distinctions, differentiations of this type would be in line with the differences in the willingness to pay for safety of the different groups affected.

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[38] *See, e.g.*, U.S. OFFICE OF MANAGEMENT & BUDGET, REGULATORY PROGRAM OF THE UNITED STATES GOVERNMENT, APRIL 1, 1990-MARCH 31, 1991, at 660-66 (1991) [hereinafter 1990-91 REGULATORY PROGRAM].

[39] *See, e.g.*, 1988-89 REGULATORY PROGRAM, *supra* note 17, at 36.

[40] Income status and other factors conceivably will affect the value of life, though these considerations are controversial and generally have not entered into the policy debate over specific regulatory actions. Consideration of income status is certainly not unprecedented in other contexts. For example, in wrongful death and personal injury actions, the value of compensation will be governed by the present value of lost earnings. Martin B. Adams & Glenn W. Dopf, *Selected Topics in Damages in Personal Injury Actions*, *in* PROVING AND DEFENDING AGAINST DAMAGES IN PERSONAL INJURY LITIGATION 55 (PLI Litig. & Admin. Practice Course Handbook Series No. 465, 1993). The present value of lost earnings will clearly increase with one's income level. For example, doubling one's annual income will double the present value of the earnings lost. Similarly, to the extent that some groups in society are willing to pay more to prevent risks than others, then it may be desirable to place a higher societal willingness to pay to reduce risk to them than to those more willing to bear risk.

It is for this reason that voluntary risks may well merit quite different treatment than involuntary risks. If people choose to incur high risks knowingly, as in the case of those who engage in risky recreational activities or who work at high risk jobs, they have revealed through their decision a lower value of life. We may consequently wish to place a lower benefit value on reducing risks to these groups then we would to victims of involuntary risks. Following this logic, reducing environmental risks that affect broad population groups who have typically not chosen to be exposed in this manner should be accorded a higher priority than, for example, achieving a comparable risk reduction that would affect cigarette smokers who have chosen their activity and are compensated for their risk by the pleasures they derive from it.

D. *The Benefit-Cost Analysis Debate*

One possible reason for policymakers' reluctance to make such distinctions is that it may not be politically defensible to appear to place a greater value on saving the rich than the poor. However, in the airline safety case, as well as in many other regulatory contexts, this argument does not have much force. If the government were paying for the added safety through budgetary allocations, there might be some reason to dispute a differential emphasis if the poor were not compensated in some manner. However, in the case of airline safety, the government is not conferring a subsidy on the wealthy airline passengers. Instead, it is imposing a cost on airlines that will ultimately be reflected in higher ticket prices. Those who will pay for the greater safety will be the airline passengers themselves and, to a lesser extent, the stockholders in the airline companies. Since the beneficiaries of the safety effort will ultimately be the ones bearing the financial burden of the regulation, there should be less reluctance to make policy distinctions for the heterogeneity in the value of life than if there were no such linkage.

These concerns with differences across society reflect some general aspects of the debate over benefit-cost analysis. In particular, benefit-cost analysis is compelling if the individuals who "lose" under a particular policy are compensated for their losses. In that situation, all individuals' welfare will be improved through the policy. If, however, compensation is not paid, there will be both winners and losers from a policy. Although one possible approach is to treat symmetrically the gains to those who benefit from the effort and the losses from those who suffer, it is not always the clearcut choice.

Consider smoking, for example. Suppose that smokers derive $20 billion in benefits from their ability to smoke in public places. Also, suppose that nonsmokers do not wish to be exposed to the smoke, either because of perceived adverse health effects or simply because of their view that environmental tobacco smoke is unpleasant. How large must the losses to the nonsmokers be for it to be desirable to eliminate public smoking? Under a benefit-cost test, provided that the losses to nonsmokers are below $20 billion, one should not undertake such regulation. In the current anti-smoking environment, however, there appears to be little effort to undertake such balancing judgments. The existence of any negative effects, particularly any negative adverse health effects, has begun to loom particularly large within the context of these debates. The standard economic approach would ask whether the enjoyment smokers derive from smoking in public exceeds the value of the adverse health effects and the discomfort to nonsmokers, whereas the public discussions have devoted little attention to the smoker benefit aspect of this comparison.[41] Even if there were such a calculation, there might be substantial resistance to benefit-cost analysis. If the losses to nonsmokers were $19 billion and the benefits to smokers were $20 billion, public smoking would pass the benefit-cost test. However, unless the nonsmokers were compensated in some way, they would not share the enthusiasm for the policy outcome that efficiency-oriented economists have.

In a world in which there are a variety of policies, there are often winners and losers from many regulatory efforts. In the usual case, those adversely affected are seldom narrowly defined groups, such as the nonsmokers, but instead are broadly based constituencies of consumers who pay higher prices and taxpayers who face increasing deductions from their income. In a policy world in which there are multiple government programs, our perspective should focus on the net effect of all policy efforts rather than on requiring that every policy make all citizens better off.

The general resistance to benefit-cost analysis may also stem from a concern that society should not balance risks against cost but instead should make some absolute commitment to an adequate level of safety unconstrained by financial concerns. The economists' rejoinder is that the level of safety considered "adequate" clearly depends on the cost of achieving the safety improvement.

The fact that most government policies would not pass a benefit-cost test reflects the resistance by government to adopt a benefit-cost approach. Table 2 lists the cost per life saved for a wide variety of regulations. This table is similar to that presented by Justice Breyer, as both of them are based extensively on as-

[41] Perhaps the best indication of the neglect of the benefit to smokers is that EPA's economic assessment of restrictions on smoking in public places does not assign any dollar benefit whatsoever to the lost enjoyment of smokers but instead focuses only on the losses to nonsmokers. *See* David H. Mudarri, United States Environmental Protection Agency, The Costs and Benefits of Smoking Restrictions: An Assessment of the Smoke-Free Environment Act of 1993, H.R. Rep. 3434, Executive Summary 10 (1994).

sessments by OMB.[42] As this ranking indicates, the reality of risk regulation policy-making is not to screen out regulations utilizing a benefit-cost test. If we adopt a value of life threshold in the range of $5 million, just over one-third of the regulations in Table 2 would pass a benefit-cost test, with the Federal Aviation Administration (FAA) accounting for many of these passing regulations. The regulations at the bottom of the table would fail a benefit-cost test. Indeed, in the case of one finalized regulation—the 1989 EPA asbestos regulation—the cost per life saved is over $100 million.

Table 2 suggests that OMB did not reject any regulatory proposals with a cost per life saved under $142 million.[43] Thus, even though the executive order empowering OMB oversight effort requires it to reject regulations that do not pass the benefit-cost test, OMB has eliminated only the most inefficient regulations.[44] The legislative mandates of many regulatory agencies require that policies be based on criteria other than benefit-cost analysis, such as elimination of all significant risks,[45] and such legislative mandates override the authority of OMB to eliminate inefficient regulatory efforts.

TABLE 2*

The Cost of Various Risk-Reducing Regulations Per Life Saved

Regulation	Year & Status**	Agency	Initial Annual Risk***	Annual Lives Saved	Cost Per Life Saved (Millions of 1984 $s)
Pass Benefit-Cost Test:					
Unvented Space Heaters	1980 F	CPSC	2.7 in 10^5	63.000	.10
Oil & Gas Well Service	1983 P	OSHA-S	1.1 in 10^3	50.000	.10

[42] *See* BREYER, *supra* note 5, at 24-27. In particular, each of these analyses draws on numbers that were originally generated by John F. Morrall, III, a Bureau Chief in the OMB, Office of Information and Regulatory Affairs. *See* John F. Morrall, III, *A Review of the Record*, REG., Nov.-Dec. 1986, at 25, 25-34 (drawing upon some of the results reported in RISK BY CHOICE, *supra* note 3, and updated by the author via unpublished communication, July 10, 1990).

[43] *See infra* Table 2, col. 2 (indicating those regulations which were rejected).

[44] 1990-91 REGULATORY PROGRAM, *supra* note 38, at 665.

[45] *See supra* note 3.

Cabin Fire Protection	1985 F	FAA	6.5 in 10^8	15.000	.20
Passive Restraints/ Belts	1984 F	NHTSA	9.1 in 10^5	1,850.000	.30
Underground Construction	1989 F	OSHA-S	1.6 in 10^3	8.100	.30
Alcohol & Drug Control	1985 F	FRA	1.8 in 10^6	4.200	.50
Servicing Wheel Rims	1984 F	OSHA-S	1.4 in 10^5	2.300	.50
Seat Cushion Flammability	1984 F	FAA	1.6 in 10^7	37.000	.60
Floor Emergency Lighting	1984 F	FAA	2.2 in 10^8	5.000	.70
Crane Suspended Personnel Platform	1988 F	OSHA-S	1.8 in 10^3	5.000	1.20
Concrete & Masonry Construction	1988 F	OSHA-S	1.4 in 10^5	6.500	1.40
Hazard Communication	1983 F	OSHA-S	4.0 in 10^5	200.000	1.80
Benzene/Fugitive Emissions	1984 F	EPA	2.1 in 10^5	0.310	2.80
Fail Benefit-Cost Test:					
Grain Dust	1987 F	OSHA-S	2.1 in 10^4	4.000	5.30
Radionuclides/ Uranium Mines	1984 F	EPA	1.4 in 10^4	1.100	6.90
Benzene	1987 F	OSHA-H	8.8 in 10^4	3.800	17.10
Arsenic/Glass Plant	1986 F	EPA	8.0 in 10^4	0.110	19.20
Ethylene Oxide	1984 F	OSHA-H	4.4 in 10^5	2.800	25.60
Arsenic/Copper Smelter	1986 F	EPA	9.0 in 10^4	0.060	26.50
Uranium Mill Tailings Inactive	1983 F	EPA	4.3 in 10^4	2.100	27.60
Uranium Mill Tailings Active	1983 F	EPA	4.3 in 10^4	2.100	53.00

Asbestos	1986 F	OSHA-H	6.7 in 10^5	74.700	89.30
Asbestos	1989 F	EPA	2.9 in 10^5	10.000	104.20
Arsenic/Glass Manufacturing	1986 R	EPA	3.8 in 10^5	0.250	142.00
Benzene/Storage	1984 R	EPA	6.0 in 10^7	0.043	202.00
Radionuclides/ DOE Facilities	1984 R	EPA	4.3 in 10^6	0.001	210.00
Radionuclides/ Elem. Phosphorous	1984 R	EPA	1.4 in 10^5	0.046	270.00
Benzene/ Ethylbenzenol Styrene	1984 R	EPA	2.0 in 10^6	0.006	483.00
Arsenic/Low-Arsenic Copper	1986 R	EPA	2.6 in 10^4	0.090	764.00
Benzene/Maleic Anhydride	1984 R	EPA	1.1 in 10^6	0.029	820.00
Land Disposal	1988 F	EPA	2.3 in 10^8	2.520	3,500.00
EDB	1989 R	OSHA-H	2.5 in 10^4	0.002	15,600.00
Formaldehyde	1987 F	OSHA-H	6.8 in 10^7	0.010	72,000.00

* FATAL TRADEOFFS, *supra* note 2, at 264 (based on information presented in Morrall, *supra* note 42, at 30).
** "P" indicates that rule has been proposed; "R" indicates that rule has been rejected; "F" indicates that rule is final.
*** Annual deaths per exposed population. An exposed population of 10^3 is 1000, 10^4 is 10,000, etc.

Although it would seem ideal if society could eliminate all premature causes of death, doing so is not feasible because society's resources do not permit it. If the entire U.S. gross domestic product were devoted to eliminating only accidental deaths, so that all illnesses and nonfatal injuries would not be affected, the country would only have the resources to spend $55 million per accidental death to reduce these risks.[46] In doing so we would leave ourselves no resources for any other expenditures, including many mortality-related expenditures such as food, health care, and education. Tradeoffs between risk and monetary expenditures are inevitable as long as the world's resources are constrained and there remain additional opportunities for en-

[46] FATAL TRADEOFFS, *supra* note 2, at 5.

hancing safety on which people are willing to spend money. If drivers were truly indifferent to spending more to enhance safety, cars would all resemble tanks. Doing so is not sensible because of the higher fuel costs and time costs incurred by riding in such vehicles. These costs would be irrelevant if safety alone influenced our decisions, which is what much public rhetoric and congressional legislation would lead us to believe should be the case. Yet, the fact that society has broader concerns requires people to make tradeoffs. As the previous discussion has illustrated, the procedure most frequently advocated by economists is the benefit-cost test. Parts II and III explore other alternative approaches implicit in the various arguments advanced by Justice Breyer.

II

Cost-Effectiveness Measures and the Automobile Safety Personal Choice Reference Point

Failure to apply an explicit benefit-cost test in the manner akin to Equation 1 does not imply that risk policy judgments are being made incorrectly. In particular, one can recast Equation 1 somewhat differently by rearranging terms, leading to the cost-effectiveness test:

$$\frac{\text{Cost}}{\text{Lives Saved}} < \text{Value of Life.}^{47} \qquad (2)$$

The left-hand side term in Equation 2 is the cost-effectiveness measure; that is, it represents the cost that must be expended per statistical life saved. Ideally, one would want to undertake all expenditures for which the cost per life saved were less than the value of life.[48] Doing so yields the same result as the benefit-cost test in Equation 1. Justice Breyer, however, in assessing risk, utilizes automobile safety as a personal choice reference point in order to compare public risk choices with private decisions. Employing this process, Breyer completely avoids determining the value of life. Thus, this method of risk assessment concentrates

[47] This equation will be referred to throughout as Equation 2.

[48] Similarly, in the case of the cost-effectiveness measures, one can also make quantity and quality adjustments by, for example, equalizing the cost per discounted year of life saved across different policy options.

solely on the left-hand side term in Equation 2, or simply, the cost per life saved.

Where there are a variety of opportunities to enhance risk and where the extent of the risk reduction is continuously altered, the desired outcome is to equalize the cost per life saved in all contexts. In particular, the stringency of society's risk reduction efforts should be increased so that the cost per statistical life saved is identical, whether the situation pertains to home accidents, work accidents, or environmental exposures. If there is some discrepancy, such as a lower cost per life saved for automobile accidents, then resources should be reallocated and more attention should be devoted to this area than to other safety contexts for which the cost per life saved is higher. Doing so will save more statistical lives for less money than if the cost per life saved were not equalized in different settings.

This general principle is implicit in Justice Breyer's discussion of whether some of the particularly expensive risk regulation efforts are ill-chosen. Breyer frames the risk reduction decision in terms of an individual's personal willingness to spend money for improved automobile safety.[49] The regulatory issue that he initially considers is asbestos removal costs.[50] In particular Breyer considers whether it is worthwhile to allocate $100 billion to remove asbestos from schools given the magnitude of the risks involved. Justice Breyer reasons as follows:

> A mid-range $100 billion figure, assuming a mid-range ten lives saved annually for forty years, means an expenditure of $250 million per statistical life saved over forty years. Is this sensible? We can translate the figure into a more intuitively accessible number by recalling that auto accidents kill about fifty thousand people each year. We might then imagine how much we would willingly pay for a slightly safer car, a car that would reduce auto deaths by, say, 5 percent, to 47,500. Would we pay an extra $1,000 for such a car? An extra $5,000 for that added contribution to safety? To spend $100 billion as a nation to save ten lives annually assumes we value safety so much that each of us would pay $48,077 extra for any such new, slightly safer car. Perhaps the cost estimates are exaggerated. Perhaps Americans are more willing to run voluntary, automobile-related risks, than to run involuntary, school-related risks; perhaps they believe death (at an old age) by can-

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[49] BREYER, *supra* note 5, at 13-14.
[50] BREYER, *supra* note 5, at 12-13.

> cer is worse than death (at a younger age) in an auto accident. So, let us divide the estimates in half, and in half again. We would still find that the slightly safer car cost over $12,000 extra. Compare airbags, which cost $200 to $500 per car and may save 3,000 to 10,000 lives per year. It seems unlikely that the public would pay 24 to 60 times more per car to save far fewer lives.[51]

Justice Breyer proceeds to analyze other types of regulation, such as asbestos shingles and asbestos coating.[52] For example, these regulations, which would only cost $200 million to $300 million per year, would be sensible to pursue if we were willing to pay $6,400 extra for each new, slightly safer car (five percent safer).

Clearly, one can apply the safer car reference point in other contexts as well. The key economic question that I will address here is the extent to which this private reference point for risk reduction comparisons provides a reasonable basis for assessing the risk regulation policy options. Viewed in terms of the cost-effectiveness measure discussion above, the Breyer discussion suggests that internal consistency in decision-making demands that one should be willing to spend the same amount on auto safety choices in terms of the cost per life saved on an individual basis as on a societal basis. This correspondence certainly appears reasonable since the collective cost ultimately will be borne by individuals within our society.

Reliance on our private valuations assumes that there is a strong relationship between our private willingness to pay for safety and what we would pay for safety from publicly provided sources. Presumably the mechanism by which the safety is provided is not consequential in most instances so that we can focus on the outcome as the matter of interest rather than the process by which it is generated. By comparing the cost-effectiveness of public and private choices and requiring a degree of consistency within those choices, it is clear that unreasonable regulations imply unreasonableness in other contexts. Since at present more modest actions have been chosen, Breyer's approach highlights the need for balance in our public risk reduction decisions.

The cost-effectiveness approach appears quite different from a mechanical calculation of the benefits and costs of a policy.

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[51] BREYER, *supra* note 5, at 13-14.
[52] BREYER, *supra* note 5, at 14.

However, is it truly substantively different? Will different kinds of policies be adopted under the Breyer auto safety reference point than under a benefit-cost test? Within the traditional benefit-cost framework, the task is to place a dollar value on human life, multiply it by the lives saved, and assess whether the regulation passes the test. Or, in terms of Equation 2, the analysis takes some specific dollar figure for the value of life and asks whether the cost per life saved is below this amount. The difference in Justice Breyer's approach is that he does not assign a specific number to the value of life. Instead, he attempts to identify reference points from other decisions we make about risk and asks whether we would want to alter these decisions in a manner that would imply greater risk reduction than we have currently chosen.

This thought process is simply a more fully articulated version of what is entailed in the benefit-cost approach. The value of life numbers used in the benefit-cost calculations are derived from the implicit decisions people make in their risk-taking behavior. The most commonly used metric is based on the extra wages that workers are paid for taking on additional risk.[53] However, there have also been studies of the automobile price-risk relationship that have yielded very similar values.[54] The only difference between the approaches is that the direct benefit-cost approach would take these explicit value of life estimates based on statistical analyses and insert them into a formal quantitative analysis, without formally articulating the genesis of these numbers for each regulatory policy decision. Breyer's approach, on the other hand, leads one through the risk tradeoff process that generates these value of life numbers. Instead of assigning a dollar value to life, he asks whether the private safety decisions that would have led to some dollar value under the benefit-cost analysis still appear desirable given an apparent willingness to opt for very stringent risk regulations in public risk regulation contexts.

Analytically, the two approaches are identical. The Breyer cost-effectiveness approach is in no way more limited than the formal benefit-cost test. Both approaches will lead to the same policy outcomes, provided that individuals maintain the risk-taking preferences they made in contexts such as Breyer's automobile risk reference point. Yet, Breyer's approach sacrifices the

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[53] *See, e.g.*, FATAL TRADEOFFS, *supra* note 2, at 34-41.
[54] *See* Atkinson & Halvorsen, *supra* note 29, at 135-36.

brevity associated with the mechanical implementation of a benefit-cost test using a pre-established value of life number. He gains a formal articulation of the economic reasoning underlying the benefit-cost test that will force people to impose some internal consistency on their views throughout the logic of the risk-cost tradeoff process.

Use of the cost-effectiveness measure to resolve inconsistencies may apply to government policies as well. Ideally, all government agencies should tighten regulations until they have the same cost per life saved.[55] As Table 2 indicates, substantially more lives could be saved for less money if there were a reallocation of resources across government agencies. Based on these estimates, the FAA regulations appear to be a comparative bargain in that their costs are considerably below the $5 million per life threshold.[56] In contrast, many other regulatory agencies, such as OSHA and EPA, appear to have often issued excessively stringent regulations.[57]

If the populations protected by these regulations were identical, it would be desirable to equalize the cost per life saved across federal agencies and make this amount consistent with what an individual would choose in terms of relative degree of safety. This is a problem of inconsistency to which Justice Breyer devotes substantial attention.[58] Breyer notes, for example, that "the values that regulators implicitly attach to the saving of a statistical life vary widely from one program or agency to another."[59] Although he does not link the discrepancies among agencies back to his automobile safety case, he does link them to the implicit value of life cutoff from the labor market, citing my estimates of the value of life in the range of $5 million to $6 million.[60] Thus, Breyer's approach, in effect, utilizes cost-effectiveness analysis by calculating the cost per life saved and hypothesizing a possible value of life reference point as a cutoff. Since his value of life reference point is the same value that one

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[55] There are two qualifiers to this approach. First, the affected populations should be the same. Second, it should be feasible to vary the stringency of the regulations on a continuous basis.

[56] FATAL TRADEOFFS, *supra* note 2, at 52-54 (incorporating information presented in Morrall, *supra* note 42, at 30).

[57] FATAL TRADEOFFS, *supra* note 2, at 52-54.

[58] BREYER, *supra* note 5, at 21-28.

[59] BREYER, *supra* note 5, at 22.

[60] BREYER, *supra* note 5, at 97 n.110.

would use in the context of a benefit-cost analysis, it would lead to the same result.

Within the context of his discussion of inconsistency and cost-effectiveness, Breyer turns to a principal theme that has been the subject of substantial recent debate, namely, the role of regulatory expenditures in depressing individual income, and thus boosting societal mortality rates. Unlimited expenditures for life-saving efforts are not desirable because such expenditures will make us poorer.[61] Higher income levels have been associated with increased longevity throughout human history.[62] As our income levels have risen, we have improved our nutrition, our health care, and other health-related activities in a manner that has led to great advances extending human life.[63] The early debate focused on a tradeoff rate of $7.25 million in regulatory expenditures that would lead to the loss of one statistical life.[64] Based on these estimates, any time the government spent $7.25 million or more to save a statistical life, at least one life would be lost because society would be made poorer by these costs. However, this $7.25 million number at face value appears to be implausible. How is it that society would be willing to spend from $3 million to $7 million to save a statistical life, while at the same time such an expenditure would lead to the loss of a statistical life because of its effect in making us poorer? Clearly there is some inconsistency with these estimates as either the implicit value of life estimate is too high or the amount of expenditure that will lead to the loss of a statistical life is too low.

The estimates I have developed for OMB, which are based indirectly on the value of life estimates from the standpoint of prevention, suggest that for every $50 million drop in societal income there is a loss of one statistical life because of the mortality-income relationship.[65] Thus, many of the regulations included

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[61] BREYER, *supra* note 5, at 23.

[62] BREYER, *supra* note 5, at 23.

[63] BREYER, *supra* note 5, at 23-28. The link between income and health has also been recognized by a federal appeals judge who stated that "larger incomes can produce health by enlarging a person's access to better diet, preventive medical care, safer cars, greater leisure, etc." International Union UAW v. OSHA, 938 F.2d 1310, 1326 (D.C. Cir. 1991) (Williams, J., concurring separately).

[64] BREYER, *supra* note 5, at 23.

[65] *See* W. Kip Viscusi, *Mortality Effects of Regulatory Costs and Policy Evaluation Criteria*, RAND J. ECON., Spring 1994, at 94, 108 (reporting the $50 million figure developed for OMB).

in Table 2, such as the EPA uranium mill tailings regulation and the OSHA asbestos regulation, do not on balance save lives. Rather, their costs are so great that they lead to more lives lost than lives saved. Once it is recognized that exorbitant expenditures per human life saved may be detrimental, realization that limits must be imposed on the stringency of risk regulations will follow.

Nevertheless, there may be some differences in the valuation of privately and publicly provided safety in that the altruistic values of society with respect to safety improvements of others should be taken into account as well.

Treating altruism within the context of risk regulation policies is potentially problematic. An important concern is the extent to which altruistic concerns embody a legitimate concern with the well being of others as opposed to a desire to impose risk preferences on them. It may be, for example, that we would not ourselves wish to be exposed to the same level of risks as those borne by coal miners. That desire may lead to an impetus to impose job safety standards that ultimately may reduce their wages and employment prospects. These types of regulations may be in the best interests of the miners if they do not accurately perceive the risks and understand the consequences of these hazards for their welfare. However, if they do understand the risks and are in fact compensated for them through higher wages, then, based on the preferences of the miners themselves, their welfare may not be enhanced by imposing regulatory requirements that disrupt their current employment relationships.[66]

An additional concern with respect to altruism is that if the altruistic concern is taken into account in ascertaining the benefits of risk regulation policy, then the altruistic concern should be taken into account in determining the costs as well. Regulations impose a variety of costs by raising product prices, reducing worker wages, and increasing taxes. Such costs reduce individual welfare. To the extent an altruistic concern with welfare levels exists, there will be an altruistic component to the cost of regulation. The critical question is whether there is a net altruistic benefit derived from the regulatory activity, which presumably

[66] This assumes the fact that coal miners have some mobility in their choice of occupation. Thus, their decision to work in the mines is a result of assessing the risk and compensation rather than being captured labor.

should stem from society's special concern with health status as opposed to other welfare-enhancing aspects of people's lives.

III
Risk Magnitude and Cigarette Smoking on the Risk Ladder

Reformulating the condition for policy attractiveness so that the focal point of interest is the number of lives saved yields the following rearrangement of Equation 2:

$$\text{Lives Saved} > \frac{\text{Total Cost}}{\text{Value of Life.}} \quad (3)$$ [67]

Under this formulation, a policy is attractive provided that the expected number of lives saved exceeds its total costs divided by the value of a statistical life. This formulation lacks the intuitive appeal of the cost per life saved measure that was the focal point of Equation 2. As a consequence, to the extent that risk analysts address the risk magnitude as a concern, it is usually in terms of discussing simply the expected number of lives saved. Justice Breyer follows this trend in his examination of a risk magnitude test that is based upon a comparison of various risks to cigarette smoking on a risk ladder.[68]

Since only one term of the benefit-cost analysis is usually examined under this equation, there is no assurance that simply focusing on the risk magnitude within this context will lead to an appropriate decision. The main reason for this inadequacy is that the risk alone is not sufficient to dictate the desirability of policy action. What matters is the risk-cost tradeoff. This lesson is apparent within the context of U.S. government regulations, often in ways that may be surprising. For example, FAA once chose not to require wing modifications for the DC-10 that cost $2000 per plane because it would reduce the risk of an accident involving the plane by only one in a billion.[69] However, for any reasonable estimate of the number of times the plane would fly and the number of passengers on the plane, this regulatory expenditure would have been desirable. Thus, focusing on the risk, which may appear to be small, may not be sufficient since the costs may

[67] This equation will be referred to throughout as Equation 3.
[68] *See* discussion *infra* notes 72-75 and accompanying discussion.
[69] Risk by Choice, *supra* note 3, at 112-13.

be small as well. There is simply no substitute for looking at the extent of the risk reduction and what we must expend to achieve this risk reduction, in order to formulate a sound regulatory policy.

The expected number of lives saved consists of two components: the probability that mortality will be reduced and the number of people affected. Some discussions of risk emphasize how small the relevant probabilities are as a way of suggesting that very little is being accomplished for what may be very substantial expenditures. In other cases, particularly with respect to the recent debate over Superfund, the focal point has shifted to the number of people exposed.[70] In particular, the government has devoted substantial resources to cleaning up hazardous waste sites in areas where there are no populations at risk.[71] It appears that greater gains could be achieved by reallocating our cleanup efforts so that the sites that pose real risks to current populations would receive greater attention.

Breyer also focuses on the risks, presenting a risk ladder as a mechanism for indicating the relative magnitude of the risk.[72] The main reference point used in the risk ladder is cigarette smoking.[73] For example, the risk of being killed in five airline trips is equivalent to smoking ten cigarettes, whereas the risk of being a sky diver is less than that of being a pack-a-day smoker. This cigarette metric[74] is a means for converting risk into units that are more readily understood. However, this metric appears to be less attractive than the automobile accident risk metric that Breyer utilized.[75]

First, the majority of the U.S. population does not smoke.[76] Therefore, most Americans have rejected incurring any risk from

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70 W. Kip Viscusi & James T. Hamilton, *Superfund and Real Risks*, AM. ENTERPRISE, Mar./Apr. 1994, at 38.

71 *Id.*

72 BREYER, *supra* note 5, at 3-6.

73 BREYER, *supra* note 5, at 3-6.

74 *See* BREYER, *supra* note 5, at 6 (citing ROBERT CAMERON MITCHELL & RICHARD T. CARSON, REPORT TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY BY RESOURCES FOR THE FUTURE, VALUING DRINKING WATER REDUCTIONS USING THE CONTINGENT VALUATION METHOD: A METHODOLOGICAL STUDY OF RISKS FROM THM AND GIARDIA (1986)).

75 *See supra* part II.

76 Centers for Disease Control and Prevention, *Cigarette Smoking Among Adults - United States, 1992, and Changes in the Definition of Current Cigarette Smoking*, 43 MORBIDITY & MORTALITY WKLY. REP. 342, 342-46 (1994) (re-

cigarettes. Indeed, smoking is generally viewed as socially unacceptable. In contrast, in the automobile safety context, car owners have made a decision to provide for only partial safety in their cars.[77] Each owner has made implicit judgments to accept some degree of risk in that area. Thus, in the cigarette cases it is not possible to make the same kind of link back to individual decisions as in the automobile case. The smoking risk is a risk most have rejected as being too great given the pleasure we might expect to derive from smoking. Following this logic, it cannot be said that being a skydiver is acceptable from a risk standpoint because one has chosen to be a pack-a-day smoker, and one should be consistent in risk-taking behavior.

To the extent that using the cigarette reference point is useful, it is from a more limited standpoint of indicating that there are commonly incurred risks that are of substantial or much greater magnitude. This metric may help people think more sensibly about the size of the risk. However, it will not be entirely successful in enabling people to think through the tradeoff process that is necessary to lead to the sound risk policy decisions that result from the benefit-cost analysis approach or the cost-effectiveness approach.

Second, the cigarette reference point is useful only to the extent that people accurately perceive the risk and understand the risk content of the metric. The available survey evidence suggests that smoking risks are not well understood.[78] Overall, both smokers and nonsmokers overestimate the total mortality risks associated with smoking.[79] Moreover, they greatly overestimate the lung cancer risk from smoking.[80] In addition, all population groups overestimate the life expectancy loss due to smoking.[81] The usefulness of a reference risk scale will be impeded to the extent that the underlying metric is not accurately perceived.

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porting that according to the Centers for Disease Control, in 1992, 26.5% of United States adults were current smokers).

77 I am excluding from consideration the small segment of the U.S. population that chooses never to drive automobiles. In all likelihood the people who have chosen not to drive have made this decision because of the availability of public transit. Moreover, even those who do not personally drive, ride in taxis and in other people's cars. In contrast, there is a much clearer decision not to smoke taken by nonsmokers that is motivated by the substantial risk involved.

78 W. Kip Viscusi, Smoking: Making the Risky Decision 61-83 (1992).

79 *Id.* at 77.

80 *Id.*

81 *Id.* at 79-81.

There is no available evidence to suggest that smoking risk beliefs are sound, as the public has responded to the substantial publicity regarding these hazards and maintains a somewhat biased perception of the risks entailed in smoking behavior.

Third, the character of the risks is quite different from many risk contexts. In the case of sky diving, drunken driving, and job accidents, the risks are immediate. People die in their prime, and, in some cases, the victims are children with substantial life expectancies that are being lost. In contrast, cigarette smoking generally has a much more modest effect on life expectancy than acute accident events. The estimated life expectancy loss associated with cigarettes is 3.6 to 7.2 years,[82] which is comparatively short. Moreover, the loss is substantially deferred, often by many decades, whereas accidents often kill upon impact. Thus, reference to a cigarette smoking risk index may induce undue complacency.

Overall, there are a variety of competing biases at work. The over-assessment of smoking risks may make other risks appear too great when compared to the risks of cigarettes, whereas the deferred nature of smoking risks and the small extent of life lost may make other risks appear too small. Most importantly, because the majority of the population has chosen not to incur smoking risks, the cigarette risk metric will not serve as a fully adequate measure of the continuum of risk-cost tradeoffs that can be used as a reference point for risk decisions. For these reasons, the automobile safety reference point developed by Justice Breyer is a better standard than the cigarette reference.

Another simpler technique for assessing the merits of a risk reduction effort based on the magnitude of the risk effect is to examine the magnitude of a variety of different risks as a simple mechanism for putting the risk in perspective. Table 3 summarizes different activities that lead to a 1/1,000,000 risk of death. We incur a 1/1,000,000 risk of death by living two days in New York City due to the air pollution risk, flying 1000 miles by jet, eating forty tablespoons of peanut butter, or eating a hundred charcoal broiled steaks. Consideration of figures such as these often helps to put relatively small risks in perspective. Do we truly want to regulate minuscule hazards that may, for example,

[82] *Id.* at 80.

be below the risks associated with drinking water and similar commonly accepted risks?

TABLE 3*

Risks That Increase the Annual Death Risk by One in One Million

ACTIVITY	CAUSE OF DEATH
Smoking 1.4 cigarettes	Cancer, heart disease
Drinking 0.5 liter of wine	Cirrhosis of the liver
Spending 1 hour in a coal mine	Black lung disease
Spending 3 hours in a coal mine	Accident
Living 2 days in New York or Boston	Air pollution
Traveling 6 minutes by canoe	Accident
Traveling 10 minutes by bicycle	Accident
Traveling 150 miles by car	Accident
Flying 1000 miles by jet	Accident
Flying 6000 miles by jet	Cancer caused by cosmic radiation
Living 2 months in Denver	Cancer caused by cosmic radiation
Living 2 months in average stone or brick building	Cancer caused by natural radioactivity
One chest X-ray taken in a good hospital	Cancer caused by radiation
Living 2 months with a cigarette smoker	Cancer, heart disease
Eating 40 tablespoons of peanut butter	Liver cancer caused by aflatoxin B
Drinking Miami drinking water for 1 year	Cancer caused by chloroform
Drinking 30 12-oz. cans of diet soda	Cancer caused by saccharin
Living 5 years at site boundary of a nuclear power plant in the open	Cancer caused by radiation

Drinking 1000 24-oz. soft drinks from banned plastic bottles	Cancer from acrylonitrile monomer
Living 20 years near PVC plant	Cancer caused by vinyl chloride (1976 standard)
Living 150 years within 20 miles of a nuclear power plant	Cancer caused by radiation
Eating 100 charcoal-broiled steaks	Cancer from benzopyrene
Risk of accident by living within 5 miles of a nuclear reactor for 50 years	Cancer caused by radiation

* Richard Wilson, *Analyzing the Daily Risks of Life*, 81 TECHNOLOGY REV., Feb. 1979, at 40, 40-46

These questions can often be instructive, but ultimately such judgments should not be made independent of cost. For example, even small hazards may be worth eliminating if the financial expenditure involved is relatively small. However, perhaps the risk table and risk ladder are most useful in framing the terms of the debate to indicate that there is not a commitment to a zero-risk society. Many government agencies have absolutist legislative mandates that require the elimination of all significant risks or, in some cases, to ensure zero-risk. However, examination of statistics such as those in Table 3 suggests that a no-risk society is not only infeasible but is inconsistent with a host of decisions that we have chosen to make in other domains. Consideration of such risk figures ultimately should lead us back to the broader policy perspectives embodied in the benefit-cost test and the cost-effectiveness measures discussed above. Breyer undertakes a similar kind of comparison with other risks in the case of asbestos regulation.[83] In order to put the asbestos exposure in schools in terms that can be readily understood, he compares this risk to the fatality rate from whooping cough vaccinations, aircraft accidents, high school football, drownings, motor vehicle accidents, home accidents, and long-term smoking.[84] A complete comparison would have included the cost numbers associated with possible risk reductions in these areas as well. In particular, asbestos reduction may cost $100 billion. How much does it cost to

[83] BREYER, *supra* note 5, at 13.
[84] BREYER, *supra* note 5, at 13.

achieve comparable risk reduction in other contexts? Ultimately, this type of calculation leads back once again to whether the cost per life saved is out of line. If more is being spent in terms of the cost per life saved to remove asbestos from the schools, perhaps efforts should be redirected toward other, more effective regulatory efforts such as those undertaken by FAA and related policies that appear in the top portion of Table 2. The magnitude of risk has also been a more general regulatory issue with respect to all environmental risks. For example, British cancer researchers Richard Doll and Richard Peto have found that a very small percentage of the cancer risks faced are due to the environmental exposures that are the target of governmental regulation.[85] These statistics, which are cited by Justice Breyer in his discussion of whether our cancer risk policies have an appropriate focus, suggest that if efforts are redirected away from minuscule risks and attention is focused on truly substantial risks, there will be a dramatic shift in the regulatory agenda. Based on the analysis of the different causes of risk, the risks posed by tobacco and diet loom particularly large and dwarf those associated with the occupational exposures or pollution exposures that are the frequent targets of government interventions.

CONCLUSION

Although the design of risk regulations has not yet attained what might be termed the economist's ideal of maximizing the difference between benefits and costs, substantial progress has been made in the design of regulatory policy. When the risk regulation agencies began their efforts in the early 1970s, there was widespread concern that something needed to be done to address the important risks that society faces. The substantial optimism with respect to our technological capabilities in reducing risk may have led to a failure to recognize the limits of our risk regulation ventures. Over time, there has been increasing emphasis on the need to attain some degree of risk balancing. Since the Ford and Carter administrations, agencies have been required to calculate the benefits and costs of their regulatory activities.[86] In

[85] Richard Doll & Richard Peto, *The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today*, 66 J. NAT'L CANCER INST. 1191, 1256-58 (1981).

[86] President Ford established the inflationary impact process through Exec. Order No. 11,821, 3 C.F.R. 203 (1974), *amended by* Exec. Order No. 11,949, 3

the Bush and Clinton administrations, agencies have been additionally required to undergo a review by the OMB to ensure that the benefits are greater than the costs in the case of major regulations.[87] However, this test is not binding when it conflicts with the agency's legislative mandate which, in the case of risk and environmental regulations, is almost always the case. The high cost per life saved of many policies is evidence of this exemption. Nevertheless, it appears that some of the least productive regulations have been eliminated as part of this oversight process. Unfortunately, much of the policy debate has been cast in terms of whether the objective is to have more or less regulation. A more appropriate concern should be with developing better regulations. There is a legitimate need to regulate the many risks that society faces, particularly in contexts such as the environment where no market process exists that would lead to the compensation of the individuals bearing the risk or ensure that the risks were set at appropriate levels. Although there is a rationale for government regulation of risk, this mandate is not unbounded. We are increasingly recognizing that certain tradeoffs are inevitable. In some cases, opponents of regulation raise the tradeoffs issue, pointing out that the costs are not commensurate with the benefits. However, even advocates of regulation may raise the tradeoff issue in a different guise by suggesting that for the substantial costs incurred, regulatory agencies should achieve more than they have with risk regulation policies to date. Ultimately, society shares the objective of achieving the greatest risk reduction possible for the money that is spent. The political controversy can consequently focus on how far we will go in these risk reduction efforts. At the very minimum, assessment of the cost-effectiveness of different regulatory alternatives is essential to

C.F.R. 161 (1976). The Council on Wage and Price Stability was established in November 1974 within the Executive Office of the President to oversee the impact process. Through Exec. Order No. 12,044, 3 C.F.R. 152 (1978), President Carter strengthened the review process by requiring that agencies show that "alternative approaches have been considered and the least burdensome of the acceptable alternatives have been chosen." *See* RISK BY CHOICE, *supra* note 3, at 138-40.

87 President Reagan established the principles for his oversight process through Exec. Order No. 12,291, 3 C.F.R. 127 (1981). Reagan also issued Exec. Order No. 12,498, 3 C.F.R. 323 (1986), which required agencies to submit draft regulatory proposals to OMB. *See* FATAL TRADEOFFS, *supra* note 2, at 256-57. The Clinton oversight process is governed by Exec. Order No. 12,866, 3 C.F.R. 638 (1993).

enable us to target our resources most effectively. The different analytical frameworks that we can use to address these issues are quite diverse. As this Article indicates, no approach alone provides profitable insights. A complete assessment of the benefits and costs of regulation is but one mechanism for assessing the attractiveness of policies. A potentially more useful means for eliminating the different economic mechanisms at work is the utilization of a reference point based on private risk-taking activities. Justice Breyer deftly employs an automobile safety reference point in his analysis. Within the context of discussing our private risk choices, it is possible to explore the underlying risk tradeoffs that we make in other situations and assess how they will in turn influence our appropriate choice of government policies. In effect, this technique serves as a mechanism for articulating the underpinnings of the benefit-cost test and provides a framework for reexamining both public and private risk choices. Other techniques, such as examination of the risk probability levels or the regulatory costs, also may be instructive, particularly with reference to other risk situations. In some instances, simple comparisons that highlight the small magnitude of the risk compared with other risk reduction opportunities that are available may be sufficient to enable the elimination of policy options that accomplish very little. By utilizing a diversity of risk perspectives as does Justice Breyer in *Breaking the Vicious Circle*, risk policies may be better evaluated and designed. Doing so may best foster our ultimate objective of enhancing society's welfare.