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Monetizing the Benefits of Risk and Environmental Regulation

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Executive Summary

This article provides a response to the opponents of monetization of risk and environmental benefits, such as the authors of *Priceless: On Knowing the Price of Everything and the Value of Nothing*. Putting benefit values in dollar terms ensures that there will be full recognition of these benefits in the policy evaluation process, and also places them on terms comparable to program costs. Much of the article is devoted to advocating the use of the value of statistical life to value health risk reductions from government regulations. The article explores sensitive issues such as the heterogeneity of the value of statistical life with respect to income and age. While the use of a "senior discount" was controversial and involved too great of a discount, there is substantial evidence that there are age variations in the value of statistical life. The article also advocates the continued use of stated preference approaches to valuing environmental benefits, which is in contrast to the critiques of stated preference analyses by those who consider environmental resources to be priceless and by those who believe that all non-use values of environmental benefits are zero.

Monetizing the Benefits of Risk and Environmental Regulation

W. Kip Viscusi

1. Introduction

Should the benefits of risk and environmental regulations be monetized? For economists this question would not be controversial. Benefits of government policies have a value given by society's willingness to pay for these benefits, which by its very nature poses the valuation issue in monetary terms.[1] Government agencies likewise have not shied away from monetizing these benefits. However, a contrary school of thought has recently emerged, as reflected in the book by Frank Ackerman and Lisa Heinzerling, Priceless: On Knowing the Price of Everything and the Value of Nothing.[2] As the title of the book suggests, the authors oppose economists' attempt to monetize the value of environmental amenities and the value of risks to life and health. In this article, I will review the history of how monetization of benefits came to be the norm for government policy and explore some of the key economic debates that have arisen.

From an economic standpoint, the advantages of monetizing benefits are quite strong because establishing this kind of metric makes it much easier to compare benefits with costs and make choices across various policy alternatives. For example, if we have $10 million to spend, is it more worthwhile to clean up a hazardous waste site on Long Island, or to reduce water pollution levels in Wisconsin rivers by 10 percent, or to adopt safety measures that will lead to an average of three fewer schoolchildren being killed in school bus crashes? Because society's resources are limited, ultimately we must be making choices such as these across different policy domains. To assess which regulatory interventions make sense and which do not, it is essential to have a scorecard by which it is feasible to make such comparisons.

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[1] For a discussion of benefit assessment principles, see any good policy analysis text such as EDITH STOKEY AND RICHARD J. ZECKHAUSER, A PRIMER FOR POLICY ANALYSIS (W.W. Norton 1978) at 149-151.

[2] *See* FRANK ACKERMAN AND LISA HEINZERLING, PRICELESS: KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING (The New Press 2004). For a general critique of their book, see ROBERT HAHN, IN DEFENSE OF THE ECONOMIC ANALYSIS OF REGULATION (American Enterprise Institute Press 2005).

Monetization also has an additional practical benefit in a world of regulatory impact analysis. Costs are quantifiable in dollar terms, as are many benefit components, so failing to place a monetary value on seemingly intangible benefits such as environmental amenities may lead to inadequate attention to intangible benefits in the policy choice process. Monetizing these benefits puts them on equal footing with benefits that are perceived to have real economic value because they can be quantified in dollar terms.

It is useful at the outset to make clear what the target of my discussion is. From an economic standpoint, for something to be "priceless" means that it has an infinite value. Thus, if saving the snail darter is priceless, no amount of monetary cost should be spared in preserving these birds even if it depletes the entire GDP. Because no risk or environmental benefit warrants an infinite expenditure, the practical policy issue is what level of monetary cost is justified to obtain the benefit. With costs in dollar terms as our numeraire, the policy choice has the structure of involving an explicit or implicit decision that the value of the benefits exceeds that of the costs for the policy to be worthwhile. Ackerman and Heinzerling oppose this monetization, as well as the cost-benefit approach, but are not clear on what operational substitute or policy criterion they favor. However, it is doubtful that they consider any benefits to be truly "priceless" in the economic sense.

It is useful to start with a bit of background regarding how benefit assessment became a central focus of the policy evaluation process. Beginning with the Reagan administration a quarter century ago, regulatory agencies have been required to assess the costs and benefits of proposed new regulations.[3] Although the economic principles underlying such benefit assessments are well-established, the appropriate methodologies for benefit assessment continue to evolve. Moreover, as the frontiers of the benefit valuation research are extended, new controversies have arisen with respect to the appropriate valuation of these benefits. The benefits associated with health, safety, and environmental risk regulations are particularly controversial because of their distinctive economic characteristics, such as the fact that one's life cannot be replaced. Because

[3] The Reagan administration executive order was Executive Order 12,291. Exec. Order No. 12,291, 46 Fed. Reg. 13,193 (Feb. 19, 1981).

these categories of benefits have been the focal point of the "priceless" debate, this paper examines an economic approach to monetizing health, safety, and environmental benefits, with a primary focus on the value of risks to life.

The current regulatory oversight process administered by the U.S. Office of Management and Budget (OMB) Office of Information and Regulatory Affairs (OIRA) is governed by Executive Order 12866, which was issued by the Clinton administration and has remained in effect since 1993.[4] This executive order requires that agencies assess regulatory benefits and costs and suggests that they explore possible monetization of these benefits. In particular, section 1(b)(6) states: "Each agency shall assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its cost."[5]

For all major regulatory initiatives, Executive Order 12866, section 6(a)(C)(i) requires that agencies undertake the following benefits analysis: "An assessment, including the underlying analysis, of benefits anticipated from the regulatory action (such as, but not limited to, the promotion of the efficient functioning of the economy and private markets, the enhancement of health and safety, the protection of the natural environment, and the elimination or reduction of discrimination or bias) together with, to the extent feasible, the quantification of those benefits."[6]

In theory, government agencies could use a variety of possible metrics to measure benefits. One could, for example, translate benefits into equivalent numbers of statistical lives that are saved, river miles for which the water quality is improved, endangered species that are saved, or some other metric. The primary currency in which benefits are assessed is dollars because ultimately, agencies are required to compare benefits and costs. From the standpoint of maximizing social welfare, they should choose those regulations that provide the greatest net benefits to society though their legislative mandates are often framed more narrowly. Because costs are in financial terms, placing benefits in comparable terms would place them on equal footing and facilitate such comparison. Moreover, most economic commodities are traded in markets and, as a

[4] Exec. Order No. 12,866, 58 Fed. Reg. 51,735 (Oct. 4, 1993).
[5] *Id.* at 51,736.
[6] *Id.* at 51,741.

consequence, explicit monetary prices are available. As I will indicate below, many environmental commodities are traded implicitly in markets or have values that can be elicited through simulated market experiments, and, as a result, it is feasible to attach dollar values to many seemingly unquantifiable benefits.

The OMB has continued to emphasize the importance of monetizing benefits in the various reports it has issued in its efforts to outline the analytical underpinnings of regulatory impact assessment. In its 2003 OMB circular A-4, OIRA reiterated the importance of quantifying benefits. Its outline of the key elements of regulatory analysis included the following comment: "With this information, you should be able to assess quantitatively the benefits and costs of the proposed rule and its alternatives. A complete regulatory analysis includes a discussion of non-quantified as well as quantified benefits and costs. A non-quantified outcome is a benefit or cost that has not been quantified or monetized in the analysis."[7] OMB expands on these requirements by emphasizing the importance of monetizing benefits from the standpoint of establishing comparability with costs: "A distinctive feature of BCA (Benefit-Cost Analysis) is that both benefits and costs are expressed in monetary units, which allows you to evaluate different regulatory options with a variety of attributes using a common measure."[8]

Even though monetization of benefits has become a standard operating procedure as part of regulatory policy assessment, there nevertheless are legitimate economic controversies that remain. The remainder of the article explores some of the ongoing debates within the economics community as well as the more salient critiques that non-economists have offered.

2. The Value of Statistical Life Concept

Many might view it as immoral to place a value on human life. That task is fortunately not before us. What we face is the closely-related task of valuing the reduction of small risks to life. How much is society willing to pay to reduce the risk of cancer from hazardous waste exposures by one chance in 10,000 for a person exposes to

[7] U.S. OFFICE OF MGMT. & BUDGET, CIRCULAR A-4, REGULATORY ANALYSIS 3 (Sept. 17, 2003) [hereinafter OMB, Circular A-4].
[8] *Id.* at 10.

the risk over a thirty-year period? Structuring our approach to answer questions such as these is straightforward based on the fundamental guidelines for benefit assessment. The governing principle for benefit assessment generally, as well as for benefit assessment for regulatory policies, is the value of the benefit in terms of society's willingness to pay for these benefits.[9] Applying this concept to health, safety, and environmental regulations, the appropriate benefit value is society's willingness to pay for the risk reduction or environmental improvement that will result from the policy. The methodology that equates benefits with society's willingness to pay for the change in policy outcomes by its very nature is conceptually closely linked to potential monetization of benefits.

What benefit outcome is being valued depends on the policy context. For some environmental policies, the benefit outcome is quite concrete. As a result of a policy preventing pollution near national parks, visibility in those areas will improve.[10] In most instances of health, safety, and environmental regulations, the benefit is defined in terms of a distribution of possible outcomes. Thus, if a regulation by the Occupational Safety and Health Administration (OSHA) or the U.S. Environmental Protection Agency (EPA) will lead to benefits in terms of ten reduced expected cancer deaths per year, then the benefit outcome to be valued is the number of statistical lives that are saved, which for this example is ten. We do not know in advance which particular people will be saved by the regulation, nor do we know that exactly ten people will be saved every year. It could be more or less than ten, but our best estimate based on the dose-response relationship for the chemicals being reduced and the levels of exposures for these chemicals is that the mean value of the distribution of the number of lives that will be saved is ten.

This willingness-to-pay principle links up quite directly with economists' approach to valuing risks to life and health, but not to fatality valuation methodologies

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[9] OMB Circular A-4 makes the following observation: "'Opportunity cost' is the appropriate concept for valuing both benefits and costs. The principle of 'willingness-to-pay' (WTP) captures the notion of opportunity cost by measuring what individuals are willing to forgo to enjoy a particular benefit. In general, economists tend to view WTP as the most appropriate measure of opportunity cost, but an individual's 'willingness-to-accept' (WTA) compensation for not receiving the improvement could also provide a valid measure of opportunity cost." OMB, Circular A-4, *supra* note 7, at 18.

[10] Schulze, William D. et al., *The Economic Benefits of Preserving Visibility in the National Parklands of the Southwest*, 23 NAT. RESOURCES J. 149 (1983). See also the study by Lauraine Chestnut and Robert Rowe, *Preservation Values for Visibility Protection at the National Parks*, http://yosemite.epa.gov/ee/epa/eerm.nsf/9480e6b9571385658525652b00497dc9/ee97d10d71e3fad08525662400766534!OpenDocument.

used for other purposes, such as compensation for victims of wrongful death. The early studies on the value of life equated the value of people's lives to the present value of their lost earnings, as in the case of court awards for personal injury.[11] This approach has the advantage of being a magnitude that is easy to calculate. All one needs is an estimate of individual earnings at different points in time, a measure of work-life expectancy, and a rate of discount used to convert future earnings losses into present dollar terms. This approach to valuing life is appropriate for court cases in which compensation is paid to the surviving family members for a fatal accident and to the accident victim in the case of nonfatal accidents.[12] In some instances, these present value of lost earnings calculations are also reduced by either the taxes and/or the consumption value that the deceased would have had, where these rules differ by jurisdiction.

It is noteworthy that these present-value calculations will have quite strong distributional consequences. The simple mathematics is that if one's annual earnings are doubled, then the present value of one's lost earnings doubles as well. Thus, court awards will be proportional to income levels, leading more affluent accident victims to receive higher levels of compensation than less affluent victims. There is an underlying rationale for these differences and for the use of present value of lost earnings more generally to the extent that the function of such awards is to serve as insurance. People with higher income have suffered a greater income loss than those with a lower income, so that to maintain their current economic standard, higher levels of compensation are needed. This line of analysis is quite compelling in the case of monetary losses, but in the case of irreplaceable health effects, it is not obvious that a disabled person with an annual income of $100,000 should receive twice the level of compensation as a disabled person with an annual income of $50,000.[13] Thus, the court-awarded compensation amounts are not immune from potential controversy with respect to their distributional consequences.

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[11] Dorothy Rice & Barbara Cooper, *The Economic Value of Life*, 57 AM. J. PUB. HEALTH 1954, 1954-66 (1967).

[12] *See* ROGER T. KAUFMAN, JAMES D. RODGERS, & GERALD D. MARTIN, ECONOMIC FOUNDATIONS OF INJURY AND DEATH DAMAGES (Elgar Publishing 2005).

[13] W. Kip Viscusi, *The Value of Life for Legal Contexts: Survey and Critique*, 2 AM. L. & ECON. REV 195, 195-222 (2000), *reprinted in* ECONOMICS OF THE ENVIRONMENT: SELECTED READINGS (Robert N. Stavins, ed., W.W. Norton & Co. 5th ed. 2005).

Although the present value of lost earnings approach is often pertinent for insuring the income losses of accident victims, it is not linked to the guiding principle for benefit assessment, which is society's willingness to pay for the benefit. In the case of a small risk of death, such as 1 in 100,000, a person with a lifetime income with a present value of $700,000 might well be willing to pay more than seven dollars to eliminate this risk, even though seven dollars represents 1/100,000 of lifetime wealth. The appropriate matter of concern is the amount of money that the person is willing to pay to reduce the small probability of death, or the risk-money tradeoff, and this amount is not limited to the fatality risk value multiplied by one's lifetime wealth. Such a constraint is binding for the certainty of death, but not for very small risks.

Consider the following example that illustrates the fundamentals of the value of statistical life (VSL) concept. Suppose that you are in a group of 100,000 people, and that one of you will die with certainty. The risk of death is a random event that affects all people equally. How much would you be willing to pay to eliminate this risk? Suppose the answer is $70 for each person in the group. What this value implies is that collectively, the group of 100,000 people would be willing to spend $7 million to eliminate the risk of one statistical death to their group. Put in somewhat different terms, the willingness-to-pay value of seven dollars divided by the risk reduction of one chance in 100,000 also equals $7 million. Because we are dealing with the willingness to pay to reduce small probabilities of death, the $7 million value for statistical life need not be constrained by the present value of the person's earnings. The individual is not buying out of the risk of certain death, but rather is simply purchasing a minor reduction in the risk of death. The value of statistical life that would be pertinent for much greater risk reductions would, of course, be potentially different, but the amount of risk reduction associated with government regulatory policies is typically quite low.

3. Estimating the Value of Statistical Life

There are two principal approaches that can be used to derive the value of the risk-money tradeoff that people have for fatality risks—survey approaches or statistical estimates of values implied by actual risk taking decisions. One could run a survey

asking people their willingness to pay for a risk reduction. Such contingent valuation or stated preference surveys present respondents with a hypothetical fatality risk situation and ask how much they would pay for a particular risk reduction. A considerable literature has outlined requirements that such studies should meet to be reliable, such as providing a credible scenario and payment mechanism to respondents. As we will discuss below, OMB has also detailed the requirements that good stated preference studies should meet.[14] Ultimately, however, stated preferences are not real decisions. To the extent that we can elicit values of statistical life based on actual choices that people make, then it is likely that these decisions will provide more reliable evidence of people's valuation of real risks than would surveys' valuations of hypothetical risks. Nevertheless, well-designed surveys often play a quite valuable role in deriving values for environmental commodities and health outcomes for which good market data are not readily available.

The dominant source of evidence regarding VSL is derived from market data. Although risks to life are not treated explicitly in markets, they are often bundled with other commodities that are in fact traded. Workers on hazardous jobs will receive compensating wage differentials for jobs that pose additional risk. This theoretical approach, which was introduced by Adam Smith, pertains to other markets as well. Product market prices will be lower for risky products, and housing prices will be lower for houses in more dangerous neighborhoods.

It is worth noting at the outset that analyses of these various risk-money tradeoffs differ somewhat in the risk tradeoff they are measuring. The labor market wage premium for fatality risks is a willingness to accept (WTA) measure. How much must the worker get paid to be willing to incur a greater risk? In contrast, for risky products and risky houses, the measure is a willingness to pay (WTP) measure, in that a person would be paying a higher price for the product or the house for a higher safety level. For very small changes in risk, the WTA and WTP measures of the risk-money tradeoff should be the same, from an economic standpoint. However, in experimental contexts, often there

[14] In particular, see OMB, Circular A-4, *supra* note 7, at 23.

is a considerable difference in these values, as the WTA often greatly exceeds the WTP value.[15]

There have been dozens of studies of VSL using labor market data from the United States as well as throughout the world. The general approach researchers have used is to formulate a regression analysis model in which the worker's wage rate is a function of a variety of demographic characteristics and job characteristics, including the fatality rate for the worker's occupation and industry. Based on a comprehensive survey of such studies in the United States, Viscusi and Aldy (2003) found that in year 2000 U.S. dollars, the median value of statistical life was $6.7 million.[16] If a typical worker in the United States faces an on-the-job fatality risk of one chance in 25,000, a $6.7 million value of life implies that that worker receives an extra $268 per year in compensation for the additional risk. As one would expect, the estimates of VSL are lower in less affluent countries, such as South Korea, India, Hong Kong, and Taiwan.

To what extent should we view wage-risk tradeoffs implied by small risks as being reliable? While the fatality risks are now on the order of 1/25,000 annually, in earlier studies the U.S. workplace was more dangerous, with risks on the order of 1/10,000. The actual precision of such estimates should not be a matter for idle speculation. From a statistical standpoint, all such estimates have an associated estimated error, and it is feasible to construct pertinent confidence intervals around these values.

The estimates are reasonably robust and have remained quite stable over time, controlling for inflation. Similarly, VSL estimates based on labor market studies, product market studies, and housing market purchases all yield similar answers. Survey studies that specifically elicit WTP values for reductions in risk likewise generate estimates in the same range. Thus, while the various estimates do not resolve whether VSL is $6 million, $8 million, or $10 million, we can be quite confident that wildly different VSL numbers are not appropriate.

4. Heterogeneity and VSL

[15] For an example of extreme difference of this type, see W. Kip Viscusi, Wesley A. Magat, and Joel Huber, *An Investigation of the Rationality of Consumer Valuations of Multiple Health Risks*, 18 RAND J. ECON. 465 (1987).

[16] *See* W. Kip Viscusi and Joseph Aldy, *The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World*, 27 J. RISK & UNCERTAINTY 5, 63, app. tbl. A (2003).

The variables that affect differences in VSL accord with many of one's expectations. A principal implication of the Viscusi and Aldy 2003 meta analysis pertains to the income elasticity of VSL. In particular, the found that this income elasticity was in the range of 0.5 to 0.6, or put somewhat differently, a 10 percent increase in one's income will raise the value of one's statistical life by 5 percent to 6 percent. The responsiveness of the VSL to income levels is positive, as one would expect.

This positive income elasticity is consistent with other economic behaviors, given the positive relationship of a variety of health and safety expenditures with respect to individual income. Note, however, that the percentage change in the VSL with respect to a percentage increase in income is less than proportional. In contrast, the present value of lost earnings measure is strictly proportional to one's income. The role of income elasticity will be quite central to subsequent discussions of appropriate recognition of distributional considerations pertaining to VSL.

Contrary to the claims by Ackerman and Heinzerling, the VSL methodology does not assume that all deaths are equally unattractive.[17] For example, one would expect people to have a different value for death resulting from cancer as opposed to an accidental death on the job. Because market data are not well suited to making these distinctions, the emphasis instead has been on stated preference approaches in which people reveal their automobile death risk equivalent for a risk of cancer.[18] We have developed such estimates for both fatal and nonfatal cases of cancer. There have also been exploratory survey analyses of attitudes toward different types of deaths using a student convenience sample.[19]

Another possible approach to capturing differences in the quantity and quality of life is the quality-adjusted life years (QALY) methodology. This methodology seeks to take into account both the amount of life left as well as the quality of these life years, usually using some kind of stated preference format. The QALY approach may also

[17] Some confusion along these lines is exhibited in the discussion by Frank Ackerman and Lisa Heinzerling in ACKERMAN & HEINZERLING, *supra* note 2, at 70.
[18] *See* Wesley Magat, W. Kip Viscusi, and Joel Huber, *Reference Lottery Metric for Valuing Health*, 42 MGMT. SCI. 1118 (1996).
[19] *See* Cass Sunstein, *Bad Deaths*, 14 J. RISK & UNCERTAINTY 259 (1997).

entail the use of third-party experts rather than eliciting values of those actually affected by a policy. Although recognizing these two different aspects of longevity makes sense conceptually, the QALY methodology is not sound from an economic standpoint. For example, based on the QALY methodology, a 20 percent reduction in one's lifespan would have the same value if one had five remaining years of life or 50 remaining years of life.[20]

Although $7 million is a consensus estimate for VSL based on labor market studies, the value of a statistical life is not a natural constant. It may differ across time and across individuals. The VSL number simply represents the tradeoff people have exhibited between risk and money. People may have quite different preferences regarding the balance they wish to strike, just as they do for other economic commodities. Because of this heterogeneity, different samples of workers with a different mix of job risks and occupations often generate estimates of VSL that differ.

On a theoretical basis, one should be consistent and strike the same fatality risk-cost tradeoff across all domains of one's decisions, assuming that there are continuous risky choices available. Some decisions are, of course, lumpy in that you either choose to wear a ski helmet or not to wear a ski helmet. However, it is interesting that the wide range of estimates of VSL from the product and housing market often yield similar estimates to those found in the labor market, despite the mix of individuals making the choices being different and the frequent lumpiness of the decisions that are available in these contexts.

The implied VSL revealed by personal decisions is in the range of $3.8 million to $5.4 million for the purchase of used cars, $5.13 million based on a study of the purchase of new cars, at least $1 million based on seatbelt usage decisions, from $4.3 to $5 million based on housing price responses to the presence of hazardous waste sites, and at least $2.1 to $4.3 million based on the purchase of bike helmets.[21] Similarly, survey studies likewise yield expressed willingness-to-pay values that are in the single digit million dollar range.

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[20] For this critique and related comments on the QALY approach, see OMB, Circular A-4, *supra* note 7, at 13.

[21] *See* Viscusi & Aldy, *supra* note 16.

A particularly interesting manifestation of heterogeneous attitude toward risks is that of smokers. Smoking is by far the greatest health risk that millions of consumers take. To the extent that people are making consistent risk taking decisions across different domains, one would also expect smokers to exhibit different, substantially lower risk-money tradeoffs than nonsmokers.[22] Compared to nonsmokers, smokers are 10 percent less likely to wear their seatbelts, 5 percent less likely to check their blood pressure, two times more likely to have a home accident, and are 9 percent less likely to floss their teeth. Smokers also work on riskier jobs in terms of the average annual injury risk associated with the job. Moreover, controlling for the riskiness of the job, smokers are more likely to be injured. In terms of the value of statistical injury, which is the nonfatal risk analog of VSL, smokers exhibit an implicit value of $20,000 per statistical injury as compared to $39,000 for nonsmokers. A sometimes difficult question for policy analysis is the extent to which personal differences in risk preferences such as these should be reflected in policy evaluations.

In his commentary on my conferences presentation of this paper, Adam Scales raised the interesting issue of differences in VSL by gender and race. Consider first the case of labor market evidence on risk premiums for women. As one might expect, women work in jobs that are safer than those of men. Just as men receive compensating wage differentials for the job risks they face, female employees do as well.[23]

The more interesting demographic differences are with respect to race. In a recent article I examined racial differences in fatality risk premiums, which in turn can be used to calculate how VSL levels vary by race.[24] Black workers exhibited VSL levels that were below those of white workers. The more interesting aspect of the analysis was the exploration of the cause of these VSL differences. These racial differences were not solely attributable to differences in workers' attitudes toward risk, but rather, they could be traced to differences in market opportunities. White workers are choosing jobs from a different set of wage-risk combinations that is not available to African American

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[22] Most of the evidence here comparing smokers to nonsmokers is drawn from W. Kip Viscusi & Joni Hersch, *Cigarette Smokers as Job Risk Takers*, 83 REV. ECON. & STAT. 269 (2001). *See also* W. KIP VISCUSI, SMOKE-FILLED ROOMS: A POSTMORTEM ON THE TOBACCO DEAL (2002).

[23] *See* Joni Hersch, *Compensating Differentials for Gender-Specific Job Risks*, 88 AM. ECON. REV. 598 (1998).

[24] *See* W. Kip Viscusi, *Racial Differences in the Value of Statistical Life*, 27 J. RISK AND UNCERTAINTY 2, 239-256 (2003).

workers. Insofar as the differences in VSL are a consequence of less attractive job options that are possibly the result of discriminatory effects, they do not necessarily indicate a greater willingness to bear risk. An important caveat that should pertain to any attempt to recognize heterogeneity in VSL levels is that VSL studies of observed market risk tradeoffs reflect the influence of both market opportunities and preferences of those bearing the risk. Consequently, one should be cautious in attributing observed differences to risk preferences.

5. Valuing Expected Lives Saved for Policy Analysis

The watershed event that led to the use of the value-of-life methodology for regulatory benefit assessment was the 1982 debate between OSHA and OMB over the proposed new hazard communication regulation.[25] OSHA prepared a regulatory impact analysis of this costly regulatory proposal, which for the first time would have required the labeling of dangerous chemicals in the workplace. Because, in OSHA's view, life was too sacred to value, instead the agency calculated the cost of death for the workers whose lives would be saved by the proposed regulation. Using the present value of the workers' lost earnings and medical costs as a measure of the benefits value led to a relatively low benefit assessment and a subsequent OMB challenge to the regulation. OSHA then appealed OIRA's rejection of the regulation to then-Vice President Bush. I was asked by both parties to settle the dispute between the two agencies over the regulatory analysis. By using my labor market estimates of the value of life as well as the implicit value of nonfatal injuries, I was able to show that benefits were approximately an order of magnitude greater than what OSHA had estimated. The result was that benefits exceeded costs based on a proper assessment of these health and safety benefits. The day after my report in favor of the regulation reached the Reagan White House, the regulation was issued.

Since that time, there has been widespread adoption of the VSL approach throughout the federal government. The methodology offers the advantage of being

[25] For a general description of this debate and of my role in it, see Pete Earley, *What's a Life Worth?*, WASHINGTON POST MAG., June 9, 1985, at 11. *See also* W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK (1992).

based on sound economic theory and empirical work, and has the practical benefit for regulatory agencies of making their regulations look much more attractive than they otherwise would had they continued to rely on the present value of lost earnings approach.

Armed with this methodology, do we then have a basis for approaching policy decisions involving identified lives, such as a girl trapped in a well or a coal miner trapped underground? Should we apply the current VSL number of $7 million and save them only if the cost of doing so is below that amount? In these instances, the policy is not saving statistical lives but identified lives. Society's willingness to pay to reduce the risk of death for identified victims from a 100 percent chance of death to the certainty of life may be quite different than our attitude toward reducing statistical deaths arising from very small probabilities.

The identified girl in a well or trapped coal miner also have the advantage of substantial publicity that will evoke altruistic concerns. Indeed, this altruism is often so great that the special status accorded to identified lives is not restricted to people; as a society we also have a review of the willingness to spend substantial sums to try to save the lives of beached whales. Saving these identified lives also tends to be a relatively infrequent event, which may affect the extent of society's broader altruistic interests. Our willingness to pay to save identified lives may be reduced if we confronted as an identified life the possibility of saving the lives of each of the 44,800 people killed each year in motor-vehicle accidents.[26] The deaths of over 100 identified lives per day would surely generate less public attention per death than the rarer calamities that lead to trapped coal miners or sailors lost at sea.

6. Age and the Senior Discount

One of the most controversial contexts in which the heterogeneity of attitudes toward risk has surfaced has pertained to whether the lives of older people should be given a lower benefit value than for young. This general topic has come under the

[26] The motor vehicle accident death toll is from NAT'L SECURITY COUNSEL, INJURY FACTS 88 (2004).

heading of a "death discount," "senior death discount," and "senior discount."[27] The policy context in which this debate arose was the EPA analysis of the Clear Skies Initiative, in which it applied a 37 percent discount to the VSL benefit figure for those who are 65 and older.[28] The reason for the controversy was twofold. First, there was the clearly sensitive issue of whether the lives of the elderly should be valued less than the lives of the those younger than age 65. Second, because the lion's share of the benefits of the Clear Skies Initiative are for reducing fatalities among those aged 65 and over, the application of a senior discount has a nontrivial effect on the assessed benefits. In terms of the long-term exposure analysis, the reduced annual fatalities in the year 2010 would be 1,900 for those 18 to 64 and 6,000 for those aged 65 and over. Application of this senior adjustment reduces the undiscounted benefits in that year from $48.2 billion to $34.7 billion.

Much of the confusion around the senior discount debate could have been avoided had the policy debate focused on first principles. Are the lives of senior citizens worth less, and whose values count in such an assessment? The key question is whether the willingness to pay to reduce fatality risks declines with age and, if so, by how much? If all of us lived forever then there would be a quite legitimate concern about differentiating the VSL benefit value according to age. However, with a finite life span, the reduced risk to life will save a different amount of the commodity based on one's remaining life expectancy. One's willingness to pay to reduce a fatality risk is likely to vary with the amount of the remaining life, as 60 remaining life years is a larger commodity than a month or two of remaining life for individuals suffering from advanced respiratory failure.

Treating the VSL differentially based on age may seem to some to be inequitable in that the lives of people are being valued differently. By the same token, one could

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[27] See among the following journalistic accounts of this debate: Katherine Q. Seelye & John Tierney, *EPA Drops Age-Based Cost Studies*, N.Y. TIMES, May 8, 2003, at A34; John J. Fialka, EPA *to Stop 'Death Discount' to Value New Regulations*, WALL ST. J., May 8, 2003, at D3; and Cindy Skrzycki, *Under Fire: EPA Drops the 'Senior Death Discount,'* WASHINGTON POST, May 13, 2003, at E1.

[28] The 37 percent senior discount figure is from U.S. ENVTL. PROTECTION AGENCY, TECHNICAL ADDENDUM: METHODOLOGIES FOR THE BENEFITS ANALYSIS OF THE CLEAR SKIES ACT OF 2002 35 (2002), and the reduced annual fatalities figures for the regulation are from the U.S. ENVTL. PROTECTION AGENCY, TECHNICAL ADDENDUM: METHODOLOGIES FOR THE BENEFITS ANALYSIS OF THE CLEAR SKIES ACT OF 2003 (2003).

claim that it is inequitable to value the risks to life for those who have very short life expectancy at the same value as those who have a very long life expectancy, because doing so placing a much higher premium per year of life saved for the old than for the young. In the absence of empirical evidence, one can divide the estimated VSL of $7 million by the average remaining lifetime or discounted expected remaining years of life for those workers to calculate a value per life year. Doing so implicitly assumes that each life year is equally attractive.

A sounder basis for determining the appropriate benefit value is not to make appeals to one of these two equity considerations, or to speculate on how the willingness to pay to reduce risks actually varies with age. One possibility is to use labor market estimates of how the VSL varies with age. Early studies in this vein imposed empirical constraints on the VSL-age relationship that did not permit the relationship to be flexible, with the result that they estimated VSL to be a decreasing function of the worker's age.[29] More recent studies have made more refined attempts to explore the age variations in VSL. A recent paper by Viscusi and Aldy has used age-specific fatality rates to explore how labor market premiums for fatality risks vary with worker age.[30] Although the VSL does display an inverted U-shaped relationship with respect to individual age, for the oldest worker group examined, those who were aged 55 to 62, the VSL remains substantial and is on the order of $6 million.

Another study of labor market variations in VSL with respect to age by Kniesner, Viscusi, and Ziliak has focused on how recognizing the life-cycle pattern of consumption affects one's age-adjusted estimates of VSL.[31] Individual affluence rises over time, as does individual consumption, with the peak value occurring around age 50. This relationship in turn influences the life-cycle pattern of VSL. While the VSL does in fact display an inverted U-shaped pattern, the pattern for older age groups is relatively flat. Their estimates of the VSL for the oldest age group that they studied, those 57 to 65, found that using age-adjusted estimates of the VSL may actually increase estimated

[29] For a review of these studies, see Viscusi & Aldy, *supra* note 16.
[30] *See* W. Kip Viscusi & Joseph Aldy, *Labor Market Estimates of the Senior Discount for the Value of Statistical Life*, working paper, NBER and Resources for the Future (2006).
[31] *See* Thomas J. Kniesner, W. Kip Viscusi, & James P. Ziliak, *Life-Cycle Consumption and the Age-Adjusted Value of Life*, CONTRIBUTIONS TO ECON. ANALYSIS & POLICY (2006).

benefits rather than decrease them if the estimates for 57-65 year olds are reflective of the VSL for those over age 65.

What these studies suggest is that arbitrary reductions in VSL for different groups in society should be based on empirical evidence rather than on conjectures about how these values differ across society. In this instance, the role of age is quite complex as one's resources and attitudes toward risk change over time, just as does one's remaining life expectancy. Overall, willingness to pay to reduce risks of death does not decline proportionally with one's expected remaining lifetime.

Notwithstanding the lack of strong evidence for a substantial senior discount, there still remains the practical task of how to value different lifespans. Suppose an air pollution regulation will only extend the lives of those with advanced respiratory disease by two months? Surely, a VSL of $7 million is too high. Developing meaningful estimates for such a population's willingness to pay for reduced risks to life remains an open challenge, as does the development of meaningful VSL levels for children.

7. Should Income Levels Matter?

The operative benefit principle is society's willingness to pay, which in turn is intrinsically linked to people's ability to pay. Are we troubled by the fact that poor people have a different risk-cost tradeoff than do the more affluent? The appropriate benefit measure is linked to people's willingness to pay for good reason, in that this willingness to pay measure is a reflection of their actual preferences. Engaging in thought experiments about what regulations poor people would prefer if they had the same income as Bill Gates or that of a government official making over $100,000 per year will, of course, lead us to different policy choices, but these will not be choices that enhance the welfare of the poor as they perceive it. It is likely that none of my colleagues at their current income levels would find boosting their income by moonlighting doing high-rise construction work to be an attractive venture. Indeed, it is doubtful that I could find many recruits for any blue-collar job, but the fact that these positions are not in accord with their preferences does not mean that the welfare of those in these positions

would be enhanced if we banned all employment in jobs that did not provide for the same safety levels that we experience as law school professors.

As a practical matter, distinctions based on income have played a much less prominent role in regulatory contexts than in the courts. The present value of lost earnings approach yields valuations that are proportional to income. If one recognized the positive income elasticity of VSL, then there would be a 0.5 to 0.6 elasticity of VSL with respect to income. However, I know of no policy context in which there has ever been an attempt to distinguish VSL based on income levels. Rather, the same average VSL is implied to all benefits, with the result being that there is implicit redistribution to those who have a lower VSL.[32]

One context in which I have confronted this distributional concern is with respect to airline safety. In my work through a consulting firm that contracted to the Federal Aviation Administration (FAA), I analyzed what VSL should be used to assess airline safety. Because airline passengers are more affluent than the average person killed in auto crashes, I recommended that the FAA be permitted to regulate airline safety more stringently than highway safety, and I coupled that recommendation with a broader recommendation that the U.S. Department of Transportation (DOT) raise the value of life that it applies throughout the agency.[33] Although my recommendation that the FAA be permitted to use a different value of life than elsewhere in the DOT was not adopted, the DOT has raised the value-of-life benefit figure that it uses for regulatory policy purposes.

It is useful to articulate what I believe should be a general principle with respect to the treatment of income differences. In the case of airline safety regulations, the decision is whether the government should mandate that airlines install particular kinds of safety equipment, such as floor lighting, fabrics with reduced flammability, and similar improvements to aircraft safety that passengers cannot monitor readily. Federal funds are not used to pay for these improvements, as these are simply regulatory policies imposing safety requirements on airlines. These costs in turn would be transmitted through higher

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[32] I have, however, been present at EPA meetings in which policymakers have argued that EPA policies should be accorded a higher VSL for benefit assessment, because the risks are involuntary as compared to the risks workers assume on the job.

[33] A subsequent published article based on my DOT study in which I adjust results for different values of airline safety passengers is W. Kip Viscusi, *The Value of Risks to Life and Health*, 31 J. ECON. LITERATURE 1912, 1940-41 (1993) [hereinafter *The Value of Risks*].

prices to airline passengers. Thus, because in the airline safety case it is not the government's money that pays for the safety measure but rather the passengers themselves who ultimately will bear the costs, the impetus for designing regulations that reflect the tradeoffs passengers would like to make if they were informed about the safety of airlines is consistent with their preferences. If airline safety instead was being funded through general tax revenues rather than higher ticket prices, then the case for applying a differential value of life would be less compelling. In the case of highway safety policies that are broadly funded by the states and federal government, there may be an efficiency rationale for making these highways safer in Beverly Hills than in Detroit, but because these efforts are publicly funded and not the result of a private bargain compelled through government regulation, the equity case for such differential values of life is not as strong.

Based on this analysis of the role of income differences, how then should we treat the following stylized version of lifeboat access for the Titanic? Suppose that at the time that you purchased your ticket for the voyage, that you were offered the opportunity to purchase a separate ticket to be in a lifeboat, should an emergency arise. This kind of market situation is unusual, as typically there are indivisibilities in the provision of safety equipment for airplanes, as regulatory measures such as floor lighting will benefit those in coach as well as those in first class. One would expect the more affluent passengers to purchase those tickets because of their higher value of statistical life. These purchases would be private contracts, and they would be reflective of the preferences of the people who chose to purchase the ticket or who chose to forgo such a purchase. The difficulty with this market is that at the time of the ticket purchase, the individual is purchasing a reduction in the small probability of death, whereas at the time the ticket is cashed in for the ride in the lifeboat, death is a certainty for those who do not get a lifeboat seat, as opposed to a low probability lottery. The previous market bargains are likely to be untenable at the time the ship is sinking.

8. Benefit Values Used by Government Agencies

Many government agencies utilize value of life estimates that are usually based on my earlier inventory of the VSL studies in the literature.[34] Table 1 provides a listing of 16 different regulatory analyses and the pertinent values of life used to assess these benefits. The VSL numbers range from the $1 million used by the FAA in 1985 to a high of $6.3 million in many analyses performed by the EPA. Note that there has been a general increase in the valuations used over time, as the FAA value of life number in 1996 is greater than the number used by that agency in 1988, which in turn is greater than the number used in 1985.

Although regulatory agencies are often quite diligent in calculating benefits and in comparing benefits and costs, because of their restrictive legislative mandates many regulations issued generate fewer benefits than costs. One measure of the cost effectiveness of regulations is the cost per statistical life saved. As the inventory prepared by John Morrall for the OMB indicates, many regulations impose costs per life saved well in excess of the $7 million VSL figure. Regulations from OSHA and the EPA are particularly likely to be above that level, with some regulations costing more than $100 million per expected life saved.[35] Morrall's 2003 analysis updates his widely-cited 1986 table in which he showed that many regulations fail such an efficacy test because of the high cost per life saved.[36] That table included regulations that were promulgated as well as those that had been proposed and rejected, and Morrall indicated the final status of all entries in the table.[37]

In terms of the overall assessment for regulatory practice, agencies calculate benefits, but estimated benefits are often less than the cost. Transportation safety regulations are an exception; however, these regulations are not ideal because the DOT

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[34] *See The Value of Risks*, *supra* note 33.
[35] *See* John F. Morrall III, *Saving Lives: A Review of the Record*, 27 J. RISK & UNCERTAINTY 221 (2003).
[36] *See* John F. Morrall III, *A Review of the Record*, REG., Nov.-Dec. 1986, at 25-34.
[37] Somewhat curiously, even though Morrall's table included a footnote indicating which were the regulations that had been rejected, he has been criticized for not indicating which of the regulations in the list had been rejected. The same critics who voiced this complaint reproduced Morrall's table omitting the original footnote that listed which regulations were simply proposed, which had been rejected, and which were final rules. The reproduction of the Morrall table omitting this footnote appears at ACKERMAN & HEINZERLING, *supra* note 2, at 46.

has long used a VSL figure that is below the prevailing market estimates of VSL. My hypothesis is that the agency may be suffering from an anchoring bias in that it had historically used the present value of lost earnings figures applied in automobile accident cases to value lives and that subsequent changes have been incremental.

The problem of inadequate attention to balancing benefits and costs also pertains to other government policies that are not required to go through the rule-making process. The cleanup of hazardous waste sites under the Superfund program has been particularly telling in that regard. The average cost expended per case of cancer averted is over $6 billion based on an extensive study that James T. Hamilton and I did of a very large number of hazardous waste sites mandated for cleanup by EPA.[38] This profligacy is due in part to the absence of any economic efficiency requirement as well as the way in which EPA assesses risk benefits. Hypothetically exposed future populations receive the same weight as do current populations exposed to the risk. The result is that cleanups often target areas where there are very few people actually at risk, thus diverting resources from sites where real risks to existing populations could be reduced. Thus, sites with low risk reduction benefits are treated the same as sites where benefits would be greater if they were estimate properly.

What James T. Hamilton and I have shown is that the cost per case of cancer prevented is much lower at sites in which a large segment of the exposed population consists of minorities.[39] Thus, targeting cleanups based on cost effectiveness from an economic standpoint would help the poor, and as compared to the current cleanup strategy. Thus, the claim that there is a tradeoff between efficiency and equity in this instance is a false characterization of the policy problem, as greater attention to efficiency enhances environmental equity.

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[38] *See* JAMES T. HAMILTON & W. KIP VISCUSI, CALCULATING RISKS? THE SPATIAL AND POLITICAL DIMENSIONS OF HAZARDOUS WASTE POLICY 125 (MIT Press 1999).

[39] *See* HAMILTON & VISCUSI, *supra* note 38, at 157-88.

9. Stated Preference Approaches[40]

In situations in which market data are not readily available, economists have frequently used contingent valuation or stated preference models to elicit people's willingness to pay for various risk and environmental outcomes. These survey techniques have addressed a wide variety of outcomes. Among the health outcomes that have been valued are the saving of lives of post-heart attack victims, reduction of airline fatalities, throat congestion, headaches, bleach poisonings, skin poisonings, toilet bowl cleaner gassings, child poisonings, nerve disease, nonfatal lymphoma, and severe chronic bronchitis.[41]

These survey methods achieved substantial prominence with respect to the Exxon Valdez oil spill. To assess natural resource damages, economists on behalf of the state of Alaska and on behalf of the U.S. Department of Justice ran surveys to determine the value that people place on such oil spills. I was a consultant and expert witness for the U.S. Department of Justice National Oceanic and Atmospheric Administration team.

These methodologies have aroused considerable controversy, stimulated in large part by the substantial stakes of the Exxon Valdez litigation. Economists funded by Exxon criticized the contingent valuation approach because survey estimates did not satisfy basic principles of rationality.[42] Thus, for example, people should be willing to pay more to save 10,000 birds than to save 100 birds, whereas surveys suggested that

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[40] For discussion of some stated preference methods, the widespread use of stated preference approaches in the federal government, and criteria for sound stated preference studies, *see* OMB, Circular A-4, *supra* note 7, at 22-24.

[41] A review of these health-related studies appears in *The Value of Risks*, *supra* note 32, at 1940-1941. For a wide range of EPA studies of these and other related benefits matters, see http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Publications.html. For an example of EPA's use of my chronic bronchitis research, see U.S. ENVTL. PROTECTION AGENCY, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT: 1990 TO 2010 (1999). The valuation appendix is at http://www.epa.gov/air/sect812/1990-2010/ch_aph.pdf. Page H-15 of the appendix states: "…the valuation of chronic bronchitis is based on the distribution of WTP responses from Viscusi et al. (1991)." The analysis makes an adjustment to willingness to pay to account for the less severe nature of the chronic bronchitis cases reduced by the Clean Air Act. This value has become the standard chronic bronchitis valuation figure for air rules related to particulate matter.

[42] Peter Diamond & Jerry Hausman, *Contingent Valuation: Is Some Number Better Than No Number?*, 8 J. ECON PERSPECTIVES 45 (1994).

people were not responsive to the scope of the commodity being saved.[43] Somewhat surprisingly, left-wing critics of the stated preference methodology, such as Ackerman and Heinzerling, have allied themselves with these corporate critiques and expressed a substantial skepticism of the use of such survey methods.[44] Presumably these same critics who opposed the use of stated preference methods for regulatory analysis would not also have opposed the use of survey techniques to determine the natural resource damages caused by the Exxon Valdez oil spill if survey methods were the only means for developing such an estimate.

Since the time of the Exxon Valdez oil spill debate, there has been considerable progress in the development of survey methodologies, and these developments make it possible to overcome the earlier shortcomings. OMB, for example, has outlined the criteria that such stated preference methods should satisfy in order to develop credible estimates. These guidelines include accurate characterization of the good being purchased by the respondent, and a credible payment mechanism.[45]

For the past eight years, Joel Huber and I have been developing survey techniques to value what the benefit to the country is of clean lakes, rivers, and streams. Using a nationally representative sample of thousands of respondents, we found that people were able to give quite consistent answers that passed a wide variety of rationality tests. Unlike the 100 birds being equivalent to 10,000 birds phenomenon found in the surveys from over a decade ago, our survey structure yielded results in which more environmental quality was consistently preferred to less. Similarly, lower costs for environmental improvement were consistently preferred to higher costs. Responses to the survey also passed complicated dominance tests, as subjects preferred alternatives on two dimensions that were dominant choices from an economic standpoint.[46]

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[43] W. H. Desvousges et al., *Measuring Natural Resource Damages with Contingent Valuation: Test of Validity and Reliability*, *in* CONTINGENT VALUATION: A CRITICAL ASSESSMENT 91 (J. Hausman, ed., North-Holland Press 1993).

[44] *See* ACKERMAN & HEINZERLING, *supra* note 2, at 94-98. For a recent response to the Ackerman and Heinzerling critique, see the article by EPA senior economist Alan Carlin, *The New Challenge to Cost-Benefit Analysis*, REG., Fall 2005, at 19.

[45] For more discussion of these criteria, *see* OMB, Circular A-4, *supra* note 7, at 23.

[46] An example of a dominated alternative is that a policy improvement of 15 percent in water quality for $200 is dominated by an improvement of 20 percent for $200. Rational respondents should prefer a 20 percent improvement to a 15 percent improvement if they are both equally costly.

In addition to passing these various rationality tests, the study also met OMB's criteria for sound survey design, and OMB approved every pretest and final field version of the survey. The survey text defined the commodity to be valued, improvements in water quality, in great detail so that respondents would understand the good. The payment mechanism of higher cost of living after moving to a new region was also well understood and was a credible payment vehicle.

The survey methodology we used was a series of iterative choices that parallels the approach we used in other studies, such as the chronic bronchitis analysis that has been used for benefit assessment purposes by the EPA. Since there seems to be some misunderstanding on the part of people such as Ackerman and Heinzerling as to how the interview structure works, it is worthwhile to elaborate a bit on the survey methodology.[47] Figure 1 provides a sample water quality benefit valuation question. The individual has a choice between two regions, as region 2 offers a greater level of water quality that is rated good but at an annual cost of living of an additional $200. Respondents who did not express indifference to a first choice such as this considered a series of four subsequent choices, including a final dominated choice. Individuals who failed to pass the dominance test were labeled "inconsistent," and people who hit the corners of the valuation task tree were not achieving indifference had implied values that would be estimated statistically.

Only 5 percent of the respondents gave inconsistent responses to the series of iterative choice questions that forced respondents to consider tradeoffs between cost of living and water quality in pairwise regional choices.[48] Based on the initial choice, respondents' valuations are bounded from above or below depending on whether they pick the high cost of living-high water quality region or the low cost of living-lower water quality region. Respondents are then given a series of iterative choices to refine their answers further. Of these, eventually 3,254 of our respondents reached a point of indifference regarding the choices presented to them, while 403 respondents continued to

[47] In particular, they claim that only two-thirds of the respondents were able to understand the interview. *See* ACKERMAN & HEINZERLING, *supra* note 2, at 96. The one-third figure includes people who were not only inconsistent but also includes people who hit the corners of the iterative choice decision structure, and consequently does not reflect people who did not understand the interview structure. *See id.*

[48] The results below are based on unpublished computer runs for our ongoing analysis of water quality benefits for the U.S. EPA.

prefer the high water quality option and 346 continued to prefer the lower cost of living option. The fact that there are 749 respondents who are at the corners of this sequential decision choice does not imply that they did not understand the interview, or that the methodology was unsuccessful. Using two-limit Tobit estimates, it is feasible to estimate what their responses would have been had the iterative choice process continued indefinitely. Quite interestingly, these Tobit results were quite stable across the various iterations, implying mean valuations of $31 for each unit increase in water quality improvement in a 90-mile radius of one's home region.

EPA and other agencies continue to rely on stated preference methodologies because benefit assessment is quite central to the policy valuation process. In a world of limited resources, eventually tradeoffs must be made, and the monetization of these benefits serves to put these quite disparate commodities in comparable terms.

10. What Should Get Monetized? Real Versus Imaginary Benefits

An interesting policy problem stimulated in part by a question posed by Paul Portney is the weight that people should place on real benefits as opposed to imaginary benefits.[49] Consider the following variant on his Happyville problem. Suppose that there are two risks facing a population. The first chemical exposure actually imposes negligible cancer risk, but people believe the risk to be 1 in 1000. The second chemical actually does pose a risk, and people accurately assess this risk as being 1 in 10,000. Because the population in this town is 10,000, people believe that the expected number of deaths that could be prevented by addressing the first risk would be 10, whereas in fact it is zero, while the expected number of deaths from the second chemical is 1. If the cost of cleanup is identical for both chemicals and there are only sufficient funds to clean up one of these two chemicals, recognition of the primary role of citizen sovereignty would clearly lead to addressing the imaginary risk from chemical 1 and ignoring the real risk from chemical 2.

[49] For Portney's conjecture, see Paul R. Portney, *Trouble in Happyville*, 11 J. POL'Y ANALYSIS & MGMT. 131-32 (1992).

The broader question raised by this example for benefits assessment is the extent to which the government should monetize imaginary risks as opposed to real risks. The fact that people have irrational fears does not seem to warrant the calculation of any health benefit, although there might be some small benefit in terms of anxiety reduction that might be better addressed through an informational campaign rather than squandering resources. The principle I will advocate here is that monetization of benefits should be restricted to placing dollar values on the estimates of the expected number of lives saved based on scientific evidence rather than on public perceptions. For the same kinds of reasons that we would not want to ignore risks that are not known to the public, such as the hidden dangers of occupational carcinogens, we would also not want to misallocate resources by addressing risks that the public believes to be greater than is actually the case.

In some instances, government agencies may foster excessive emphasis on these imaginary risks. As noted above, by focusing on risks to hypothetical future populations the EPA often places undue emphasis on imaginary risks that will never come to pass. Justice Stephen Breyer recounts an example of a case in his court in which a Superfund site was clean enough for children to play on the site and eat small amounts of dirt for 70 days a year, but after that site was cleaned up, children would be able to eat the dirt for 245 days per year. Justice Breyer was puzzled because "there were no dirt-eating children playing in the area, for it was a swamp. Nor were dirt-eating children likely to appear there, for future building seemed unlikely."[50] This excessive focus on imaginary risks rather than real risks distorts our priorities and actually has a perverse distribution effect.

11. Risk-Risk Analysis

When monetizing the benefits of government policies, it is essential to monetize the net health and safety benefits, not the gross benefits. There may be a variety of benefit offsets, such as decreased consumer precautions in the presence of safety caps,

[50] *See* STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION 12 (Harvard University Press 1993) (footnotes omitted).

which I termed the "lulling effect".[51] There also could be ancillary safety benefits, as observed by Rascoff and Revesz.[52]

The focus here will be on the concept of risk-risk analysis in the sense of health-risk increases that result from the opportunity costs of policy expenditures. The underlying principle is that being richer is healthier, as there is a positive income elasticity of health and safety levels.[53] Judge Stephen Williams brought the risk-risk concept to the forefront of the policy debate, when he observed that very expensive OSHA regulations could lead to a net decrease in safety.[54] The rationale is that very high levels of expenditure represent an opportunity cost and take money away from consumers that could otherwise be used for health-enhancing expenditures, such as health care, safer products, and safer neighborhoods. Although Judge Williams focused on existing published estimates that indicated that expenditures of under $10 million for life saved could be counterproductive, low estimates appear to be implausible, since it is unlikely that expenditures comparable to the value of statistical life could reduce safety levels.[55] On a theoretical basis there should be a linkage between the value of life from the standpoint of prevention and the level of expenditure that leads to the loss of a statistical life. In particular, I showed that the marginal expenditure per statistical life lost equals the VSL divided by the marginal propensity to spend on health from one's income. If we focus only on health-enhancing expenditures, then the marginal propensity to spend on health is approximately 0.1, so that the level of expenditure that will lead to the loss of a statistical life is $70 million if the value of life is $7 million. Higher levels of expenditure may also lead to consumption that harms oneself. Recognizing these influences leads to a lower estimate of the expenditure level per life saved that would be counterproductive.[56]

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[51] See, for example, my discussion in W. KIP VISCUSI, FATAL TRADEOFFS (Harvard University Press 1992).
[52] *See* Samuel J. Rascoff & Richard L. Revesz, *The Biases of Risk Tradeoff Analysis: Towards Parity in Environmental and Health-and-Safety Regulation*, 69 U. CHI. L. REV. 1763 (2002).
[53] The first documentation of this relationship in the professional literature is W. Kip Viscusi, *Wealth Effects and Earnings Premiums for Job Hazards*, 60 REV. ECON. & STAT. 408 (1978).
[54] *See* Stephen F. Williams, *The Era of "Risk-Risk" and the Problem of Keeping the APA Up to Date*, 63 U. CHI. L. REV. 1375 (1996).
[55] For an example of the kind of risk-risk analysis cited by Judge Williams, see Ralph L. Keeney, *Mortality Risks Induced by Economic Expenditures*, 10 RISK ANALYSIS 147 (1990).
[56] *See* Randall Lutter, John F. Morrall III, & W. Kip Viscusi, *The Cost-per-Life-Saved Cutoff for Safety-Enhancing Regulations*, 37 ECON. INQUIRY 599 (1999). Using an estimated VSL of $5 million, that article

A set of examples in Table 2 illustrates that recognition of risk-risk tradeoffs affects the estimates of benefits. For that series of regulations, the authors calculate the net lives saved by regulations, taking into account the risk-risk tradeoffs. To monetize the benefits of these regulations, one could then apply the VSL of $7 million to the net lives saved figure, which will produce an estimate of the net monetary safety benefits resulting from the regulation. As is indicated in the table, many of these health and safety regulations are counterproductive in terms of their net effects on health and safety.

Although the "richer is safer" argument may appear to be counterintuitive, the following example shows the mechanisms at work. Suppose that regulatory policy was no more productive than paying people to dig ditches and fill them back up again. This level of efficacy is not too far removed from many of the most inefficient regulations. By diverting consumer expenditures through taxes, higher prices, or lower wages from the usual bundle of consumption goods, such a ditch-digging policy will impose net health costs through the opportunity costs of the money being expended.

Ackerman and Heinzerling criticize this risk-risk approach and express puzzlement that advocates of the risk-risk methodology have never suggested applying this methodology to other types of expenditure, such as military spending.[57] The genesis of the risk-risk methodology in policy contexts stems from the fact that regulatory agencies such as OSHA and EPA have a myopic risk-oriented approach. Unlike other government policies, risk regulation costs do not come out of general revenues, so that there are no internal budgetary restrictions. If cost does not enter policy evaluations on equal footing with benefits or possibly not count at all because of agencies' restrictive legislative mandates, then in the extreme case the only scorecard component that matters is how a regulation performs from a risk standpoint. What the risk-risk methodology points out is that even if all we are about is health and safety with cost as a matter of complete indifference, then truly wasteful expenditures on regulations are not advancing that objective. Thus, it provides a way to open the policy debate to evaluate truly ineffective policies in situations in which only risk effects seem to be of concern to policymakers.

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concluded that an expenditure of $15 million will lead to the loss of a statistical life. Use of a $7 million VSL figure rather than a $5 million figure will increase that estimate proportionately.

[57] *See* ACKERMAN & HEINZERLING, *supra* note 2, at 59.

To the best of my knowledge, a purely health-and-safety scorecard is not used outside of the risk and environmental regulation arena. If, however, the U.S. Department of Health and Human Services were to fund healthcare programs that saved statistical lives at a cost of $100 million per life, than the same type of argument regarding the counterproductive nature of such expenditures would be pertinent. Exorbitant expenditures on health and safety do not have a net beneficial effect on health.

12. Monetizing Benefits for Policy

A substantial dividend from the monetization of the benefits from risk and environmental regulation is that doing so has placed these benefits on equal footing with the quite tangible costs of these regulations. These benefits no longer are subsidiary qualitative considerations. The importance of valuing benefits and the extent to which placing such benefits on an equitable basis with costs is apparent based on the history of regulatory oversight of new government regulations.[58]

The original regulatory oversight process was only concerned with costs, not benefits. Costs were tangible monetary losses, while benefits were seemingly nebulous and more abstract environmental amenities. The Nixon administration initiated informal "quality of life" reviews that focused on the cost impact regulations had on the economy. The Ford administration formalized this process through Executive Order 11821 that required agencies to prepare inflationary impact analyses of the costs of these regulations.[59] Once again, all that mattered were the monetized costs, not the benefits, even though these also potentially could be translated into monetary terms.

The Carter administration regulatory oversight effort of Executive Order 12044 expanded the requirements to include cost-effectiveness tests.[60] The agency had to show that it was achieving the particular benefits of the regulation for the least possible cost. As with the Ford administration program, this regulatory effort was run by the White House Council on Wage and Price Stability, for which I was the Deputy Director. The

[58] The documentation of the history based on the discussion below appears in W. KIP VISCUSI, JOSEPH HARRINGTON, & JOHN VERNON, ECONOMICS OF REGULATION AND ANTITRUST ch. 2 (4th ed. 2005).
[59] Exec. Order No. 11,821, 39 Fed. Reg. 41,501 (Nov. 29, 1974).
[60] Exec. Order No. 12,044, 43 Fed. Reg. 12,661 (Mar. 24, 1978).

main focus remained on costs and inflationary impact of regulation, though the concerns were expanded to include cost effectiveness. Perhaps because of this emphasis, the kinds of monetization that are the focus of my paper were not yet undertaken by regulatory agencies. For example, agencies did not use VSL to value the benefits of regulatory efforts or undertake stated preference surveys to determine the value of environmental amenities.

Once the Reagan administration required that agencies demonstrate that the benefits of regulation exceeded the costs, agencies either could quantify the cost effects in monetary terms and compare them to the risk and environmental benefits described in a qualitative manner, or they could explore more innovative approaches to try to capture the extent to which there were real and tangible benefits from these regulatory efforts. As I indicated in my discussion of the OSHA hazard communication regulation, OSHA began using my value-of-life estimates beginning in 1982 in part because this methodology greatly enhanced the attractiveness of regulatory policies, given the substantial benefits this economic approach accorded to reducing risks to human life. Perhaps for much the same reason, the EPA has been at the forefront of developing and funding research efforts to place a dollar value on environmental amenities, ranging from improved visibility of the Grand Canyon to the value that improvements of water quality will have to people who do not even use bodies of water for fishing, swimming, or other recreational purposes.[61]

The development of new techniques for monetizing benefits has led to new controversies, both because the empirical methods themselves remain in the process of development, and because there has been an effort to extend and refine the estimates in a variety of ways. In the case of valuing statistical lives, use of these numbers is no longer regarded as controversial by regulatory agencies, as their application in benefit assessments has become routine. The issues that are now at the forefront of the policy agenda involve refinements in how such values can be applied. Most notably, the debate over whether there should be a senior discount for the value placed on the lives of the elderly for the Clear Skies initiative exemplifies the extent to which there are clearly contentious issues arising from the application of different values for different segments

[61] See http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Publications.html.

of the population. My past work indicates that the magnitude of age differences in VSL is not that substantial, and that the policy debate should not become mired in such subsidiary controversies. The more fundamental challenge is to strike a reasonable overall balance between cost and risk. Engaging in more contentious debates regarding the differences in the value of life across segments of the population seems premature given that more fundamental lack of benefit-cost balance in regulatory policies.

A substantial dividend from the monetization of risk and environmental regulatory impacts is that this process links these benefits to the fundamental economic determinants of benefit values, which is the willingness to pay of those affected by a regulation for the effects of these policies. In the case of VSL, these estimates are typically derived from the preferences that workers reveal through their risky job choices and the wage premiums they receive for risk. In the case of other environmental benefits, the main focus has been on a variety of stated preference approaches that elicit measures of the willingness to pay for the environmental benefit. By their very nature, the valuations derived from market evidence will reflect preferences of the citizenry.

The advent of stated preference methods has in turn created new components of benefits that could substantially loom large in the benefit assessment process. Perhaps the most controversial benefit component is that of nonuse or passive use of an environmental resource. Historically, economists valued the use of improved environmental resources through the recreational value of or the travel costs that people incurred to visit the environmental site. The use of stated preference approaches has greatly expanded the scope of such benefits to include the value of benefits to people who do not even directly use the environmental amenity. Thus, in the case of water quality benefits, people who do not fish, visit recreational areas, or picnic at these rivers or lakes may nevertheless express fairly substantial values for improvements in water quality in their region as well as elsewhere in the country. Nonuse benefits are legitimate but often difficult to measure, making this benefit category a prime target of critics of regulatory policies. As with market-based estimates, these elicited values will reflect the willingness to pay of the citizenry. The scope of the benefits that can be captured through the monetization of environmental benefits is quite broad and is not limited to the

kinds of activities for which one normally conceives that a market arrangement might be appropriate.

Put somewhat differently, any regulatory benefit from a risk regulation or environmental regulation that should be legitimately recognized in the policy analysis process potentially can be quantified in monetary terms. Doing so will enable these benefits to reflect the values of the people who are affected by the regulation rather than the preferences of policymakers who would otherwise seek to impose their own values on the citizenry.

My support for the monetization of environmental benefits began over three decades ago with my involvement as coauthor of a Nader study group study analyzing the dam building efforts of the U.S. Department of Interior's Bureau of Reclamation.[62] That agency could only undertake policies for which the benefits exceeded the costs. Quantified benefits such as irrigation and electric power were tallied, but environmental consequences were not, with the result being that they were largely ignored. As our report concluded:

> Why shouldn't environmental consequences of Reclamation projects also be given dollar values? Without such consideration, "tangible benefits" such as irrigation or power overshadow ecological effects. For example, in the 1960s the Bureau of Reclamation wanted to flood major portions of the Grand Canyon by building Bridge Canyon and Marble Canyon dams on the Colorado. As usual, the Bureau paid lip service to environmental considerations in the narrative section of its project reports. However, when it came to placing dollar values on project effects, environmental impacts weren't mentioned at all and played no part in the benefit-cost evaluation. Consequently, the Bureau of Reclamation added up the "tangible" benefits and costs of its projects, found that the dollar value of benefits exceeded the estimated costs, concluded that the projects were economically justified, and sent them on to Congress.[63]

How, then, did the efforts to dam up the Grand Canyon get stopped? Economist Dr. Alan Carlin, who is now a senior economist at the U.S. EPA, showed with a co-author that the quantified benefits in fact did not exceed the costs.[64] However, his analysis turned not on adverse environmental effects, which were not readily monetized in that era of economic

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[62] RICHARD L. BERKMAN AND W. KIP VISCUSI, DAMMING THE WEST: RALPH NADER'S STUDY GROUP REPORT ON THE BUREAU OF RECLAMATION (Grossman Publishers 1973).
[63] *Id*. at 75.
[64] *Id*. at 75-6, 91.

analysis, but on the overestimation of electric power benefits. It may be that Dr. Carlin's misgivings about the *Priceless* approach,[65] as well as my own resistance to the *Priceless* point of view, stems in part from our longer historical perspective. The government has already run the experiment of analyzing proposed programs with major environmental effects but not monetizing the environmental consequences. The result was not that these effects were treated as being "priceless," but instead were viewed as being worthless.

[65] For Dr. Carlin's views, *see* Carlin, *supra* note 44.

Table 1
Values of Statistical Life Used by U.S. Regulatory Agencies, 1985 – 2000*

Year	Agency	Regulation	Value of a Statistical Life (millions, 2000 $)
1985	Federal Aviation Administration	Protective Breathing Equipment (50 Federal Register 41452)	$1.0**
1985	Environmental Protection Agency	Regulation of Fuels and Fuel Additives; Gasoline Lead Content (50 FR 9400)	$1.7
1988	Federal Aviation Administration	Improved Survival Equipment for Inadvertent Water Landings (53 FR 24890)	$1.5**
1988	Environmental Protection Agency	Protection of Stratospheric Ozone (53 FR 30566)	$4.8
1990	Federal Aviation Administration	Proposed Establishment of the Harlingen Airport Radar Service Area, TX (55 FR 32064)	$2.0**
1994	Food and Nutrition Service (USDA)	National School Lunch Program and School Breakfast Program (59 FR 30218)	$1.7, $3.5**
1995	Consumer Product Safety Commission	Multiple Tube Mine and Shell Fireworks Devices (60 FR 34922)	$5.6**
1996	Food Safety Inspection Service (USDA)	Pathogen Reduction; Hazard Analysis and Critical Control Point Systems (61 FR 38806)	$1.9
1996	Food and Drug Administration	Regulations Restricting the Sale and Distribution of Cigarettes and Smokeless Tobacco to Protect Children and Adolescents (61 FR 44396)	$2.7**
1996	Federal Aviation Administration	Aircraft Flight Simulator Use in Pilot Training, Testing, and Checking and at Training Centers (61 FR 34508)	$3.0**
1996	Environmental Protection Agency	Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities (61 FR 45778)	$6.3
1996	Food and Drug Administration	Medical Devices; Current Good Manufacturing Practice Final Rule; Quality System Regulation (61 FR 52602)	$5.5**
1997	Environmental Protection Agency	National Ambient Air Quality Standards for Ozone (62 FR 38856)	$6.3
1999	Environmental Protection Agency	Radon in Drinking Water Health Risk Reduction and Cost Analysis (64 FR 9560)	$6.3
1999	Environmental Protection Agency	Control of Air Pollution from New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements (65 FR 6698)	$3.9, $6.3
2000	Consumer Product Safety Commission	Portable Bed Rails; Advance Notice of Proposed Rulemaking (65 FR 58968)	$5.0**

Source: W. Kip Viscusi & Joseph E. Aldy, *The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World*, 27 J. Risk & Uncertainty 5, 55 (2003).

Table 2.
Evaluation of Risk-Risk Tradeoff for 24 U.S. Regulations, 1986 – 1998

Regulation	Year	Agency	Discounted Statistical Lives Saved	Fatalities Induced by Cost of Regulations	Net Lives Saved by Regulations
Toxicity characteristics to determine hazardous wastes	1990	EPA	0.048	-23	23
Underground storage tanks: technical requirements	1988	EPA	1.1	-22	24
Manufactured home construction and safety standards on wind standards	1994	HUD	1.5	-3.2	4.7
Process safety management of highly hazardous chemicals	1992	DOL	220	-42	260
Regulations restricting the sale and distribution of cigarettes and smokeless tobacco to protect children and adolescents	1996	HHS	4,700	-140	4,900
Medicare and Medicaid programs: hospital conditions of participation; identification of potential organ, tissue, and eye donors; and transplant hospitals' provision of transplant-related data	1998	HHS	710	9.2	700
Quality mammography standards	1997	HHS	75	1.4	74
Food labeling regulations	1993	HHS	520	10	510
Childproof lighters	1993	CPSC	95	2.9	92
Standard for occupational exposure to benzene	1987	DOL	4.4	1.8	2.6
Occupational exposure to methylene chloride	1997	DOL	12	5.9	6.2
Occupational exposure to 4,4' methylenedianiline	1992	DOL	0.7	0.71	-0.01
Asbestos: manufacture, importation, processing, and distribution in commerce -- prohibitions (total)	1989	EPA	3.9	4.3	-0.41

Regulation	Year	Agency	Discounted Statistical Lives Saved	Fatalities Induced by Cost of Regulations	Net Lives Saved by Regulations
National primary and secondary water regulations -- phase II: maximum contaminant levels for 38 contaminants	1991	EPA	44	63	-19
Occupational exposure to asbestos	1994	DOL	13	20	-7.1
Hazardous waste management system -- wood preservatives	1990	EPA	0.29	0.83	-0.55
Sewage sludge use and disposal regulations, 40 CFR pt. 503	1993	EPA	0.24	2.6	-2.3
Land disposal restrictions for "third third" scheduled wastes	1990	EPA	2.8	30	-27
Hazardous waste management system: final solvents and dioxins land disposal restrictions rule	1986	EPA	1	12	-11
Occupational exposure to formaldehyde	1987	DOL	0.21	4.8	-4.5
Prohibit the land disposal of the first third of scheduled wastes ("second sixth" proposal)	1988	EPA	2.9	66	-63
Land disposal restrictions -- phase II: universal treatment standards and treatment standards for organic toxicity, characteristic wastes, and newly listed wastes	1994	EPA	0.16	8.3	-8.2
Drinking water regulations, synthetic organic chemicals -- phase V	1992	EPA	0.0061	3.4	-3.4
Solid waste disposal facility criteria, 40 CFR pt. 257 and pt. 258	1991	EPA	0.0049	10	-10

Source: ROBERT W. HAHN , RANDALL W. LUTTER, & W. KIP VISCUSI, DO FEDERAL REGULATIONS REDUCE MORTALITY? (AEI-Brookings Joint Center for Regulatory Studies 2000), *available at* http://aei-brookings.org/admin/authorpdfs/page.php?id-106.

Figure 1
Sample Private Water Quality Benefit Question

We would like to ask you some more questions like these. However, in these questions, one region will have a lower annual cost of living and the other will have higher water quality. **Remember that the national average for water quality is 65% Good.**			
	Region 1	Region 2	
Increase in Annual Cost Of Living	**$100** More Expensive	**$300** More Expensive	
Percent of Lake Acres and River Miles With Good Water Quality	**40%** Good Water Quality	**60%** Good Water Quality	
Which Region Would you Prefer?	Region 1 *	Region 2 *	No Preference *