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The Value of Human Life: A Case for Altruism

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ABSTRACT

The "value of statistical life" is an estimate of the monetary benefits of preventing the death of an unidentified person. It is the maximum amount government agencies will pay to save one life. Current value-of-statistical-life estimates are determined by society's willingness to pay (WTP) to eliminate private health risks. Unfortunately, agencies ignore society's WTP to eliminate others' health risks. There are two possible justifications. First, it may be that altruism does not exist: Peter is not willing to pay anything to save Paul's life. However, research evidence indicates that altruism does in fact exist. Second, some economists argue that accounting for altruism lowers social welfare because of the increased cost of saving more lives. This argument fails to consider an important form of paternalistic altruism: safety-focused altruism, in which Peter is willing to pay more for improvements in Paul's safety than for improvements in other aspects of Paul's well-being. If both rationalizations for excluding altruism are incorrect, policymakers face an unpalatable possibility: current life valuation methods are incomplete, and economically efficient environmental and health regulations are unnecessarily being rejected. If this is the case, policymakers should increase the value of statistical life to account for altruism.

I. INTRODUCTION

Many government policies prevent deaths. The Consumer Product Safety Commission's (CPSC) regulation of space heaters, for example, saves 63 lives annually, while the Environmental Protection Agency's (EPA) management of asbestos saves 10.[1] Ninety percent of the Clean Air Act's benefits are prevented deaths.[2] Life-saving programs are

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1. John F. Morall III, *Saving Lives: A Review of the Record*, 27 J. RISK & UNCERTAINTY 221, 223 (2003).

2. U.S. EPA, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT: 1990 TO 2010 101 (1999), *available at* http://www.epa.gov/air/sect812/1990-2010/chap1130.pdf (estimating that "$100 billion of the $110 billion total benefit estimate in 2010, or roughly 90 percent, is

desirable. Resources are, however, limited. It is impossible to avoid all accidental deaths.

How do government agencies determine the amount to spend on life-saving programs? Most agencies rely on the value of statistical life.[3] The value of statistical life approximates the dollar value of preventing a single death.[4] Value-of-statistical-life estimates vary across government agencies. The EPA spends up to $6.1 million to prevent one expected death.[5] CPSC spends $5 million.[6]

Most government-sponsored safety programs entail uncertainty and anonymity. For instance, it is impossible to know whose lives are prolonged through air quality improvements.[7] As a result, cost-benefit analysis (CBA) of general safety improvements requires knowledge of the value of preventing an unidentified or statistical death. In neoclassical economics, the value of an action is equal to society's willingness to pay (WTP) for that action.[8] The value of statistical life approximates society's WTP to prevent anonymous deaths.[9]

Policymakers use value-of-statistical-life estimates to value *public* risk reductions. These estimates are based on numerous risk studies. Most of these studies, however, derive WTP for reductions in *private* risks only. Hence, in practice, policymakers value public risk-reduction programs with private WTP estimates.[10] This is a subtle but important point. The current approach ignores altruism and adopts one of two

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attributable to reductions in premature mortality associated with reductions in ambient particulate matter and associated criteria pollutants").

3. The acronym VSL is commonly used in place of "value of statistical life," a convention I eschew in this essay. *See, e.g.*, Cass Sunstein, *Valuing Life: A Plea for Disaggregation*, 54 DUKE L.J. 385, 385 (2004) ("Each government agency uses a uniform figure to measure the value of a statistical life (VSL).").

4. *See* Anna Alberini, *What Is a Life Worth? Robustness of VSL Values from Contingent Valuation Surveys*, 25 RISK ANALYSIS 783, 783 (2005) ("The [value of statistical life] is a key input for computing the mortality benefits of environmental and safety policies that save lives.").

5. U.S. EPA, AGENCY GUIDELINES FOR PREPARING ECONOMIC ANALYSES 90 (2000), *available at* http://yosemite1.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html/$file/Guidelines.pdf.

6. Lisa Heinzerling, *The Rights of Statistical People*, 24 HARV. ENVTL. L. REV. 189, 191 (2000).

7. *See infra* text accompanying notes 24–26.

8. *See* BRIAN R. BINGER & ELIZABETH HOFFMAN, MICROECONOMICS WITH CALCULUS, 201–03 (2nd ed. 1998) or any standard microeconomics textbook.

9. *See* W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK 39, 69 (1992).

10. *See infra* Part II.B. By way of definition, public risk reductions, such as improvements in air quality, apply to everyone; private risk reductions, such as seatbelts, affect only the direct consumer.

implicit assumptions: either there is no disparity between WTP for reductions in private and public risks, or the gap is inconsequential. Throughout, I refer to these two assumptions as the anti-altruism assumptions.

The first assumption implies that people are not willing to pay to improve the safety of others, including family members and friends. This supposition is excessively parochial. Altruism exists if "personal welfare is affected by at least one other person's well-being."[11] Parents demonstrate altruism when they help their children cross the street, grandparents when they offer gifts to their posterity. People are concerned with the welfare of those they know. Are they similarly concerned with the welfare of anonymous persons? This question is discussed below.[12]

The second anti-altruism assumption, the idea that policymakers should ignore altruism even if it exists, also deserves attention. Professors Bergstrom[13] and Milgrom[14] maintain that both altruists' and non-altruists' WTP for public safety improvements are equivalent if people are non-paternalistic—that is, Peter's welfare is affected by what Paul values, not by what he feels Paul *should* value.[15] Thus, they insist, policymakers should ignore altruism in risk valuation.[16] Nevertheless, as noted below, their theory relies on a restrictive definition of altruism.[17]

The objective of this essay is to examine critically both anti-altruism assumptions. As it stands, one person's WTP to prevent another's death does not influence government spending on safety improvements. Is this approach correct? Should policymakers adjust the value of statistical life to incorporate altruistic concerns? If both anti-altruism assumptions are false, society's WTP for reductions in public risks, rather than its WTP for private risk reductions, should determine the value of statistical life, and policymakers should increase this value to account for altruism. These questions are crucial for they influence decisions that prevent actual deaths.

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11. THE MIT DICTIONARY OF MODERN ECONOMICS 14 (David W. Pearce ed., 4th ed. 1992) [hereinafter MIT DICTIONARY].

12. *See infra* Part III.A.

13. Theodore C. Bergstrom, *When Is a Man's Life Worth More Than His Human Capital*, *in* THE VALUE OF LIFE AND SAFETY: PROCEEDINGS OF A CONFERENCE HELD BY THE GENEVA ASSOCIATION 3, 16–18 (M.W. Jones-Lee ed., 1982).

14. Paul Milgrom, *Is Sympathy an Economic Value? Philosophy, Economics, and the Contingent Valuation Method*, *in* CONTINGENT VALUATION: A CRITICAL ASSESSMENT 417 (J.A. Hausman ed., 1993).

15. Bergstrom, *supra* note 13, at 17.

16. *Id.* at 18 (arguing that to account for altruism "would lead to inefficiency").

17. *See infra* Part III.B.1.

Part II provides a brief evaluation of historical attempts to value life, including recent efforts involving the value of statistical life. Part III reviews the literature and evidence on the existence of altruism and explores its potential role in determining the value of life. It also considers and rejects both anti-altruism assumptions, concluding that government agencies should increase value-of-statistical-life estimates. Professor Jones-Lee posits that the altruism-adjusted value of statistical life is 10 to 40 points greater than current values.[18] Part IV revaluates two recent EPA analyses using Jones-Lee's suggested adjustment. The results demonstrate that the failure to consider altruism *can* have a substantive impact on which programs are deemed economically feasible. Mathematical formulations have been relegated to the Appendix.

Unfortunately, as described below, economists disagree on the relative magnitude and sign of potential disparities between private and public WTP values; further research is justified. On the balance, however, I contend that there is sufficient evidence to warrant the augmentation of current value-of-statistical-life estimates.

II. WHAT IS A LIFE WORTH?

In the 1930s, government agencies proposed numerous federal projects, largely as a result of Roosevelt's New Deal.[19] CBA soon became popular, especially for water-related developments.[20] Within a few decades, many federal and state agencies, as well as Congress, began to require full analyses prior to approving major government actions.[21] Several U.S. presidents issued executive orders urging federal agencies to use CBA.[22] CBA's role quickly extended beyond simple water projects.

CBA is a tool that compares the expected costs and benefits of programs by converting both into dollars, a common unit of measurement. If total benefits exceed costs, projects have positive net

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18. M.W. Jones-Lee, *Paternalistic Altruism and the Value of Statistical Life*, 102 ECON. J. 80, 89 (1992).

19. *See* A.R. Prest & R. Turvey, *Cost-Benefit Analysis: A Survey*, 75 ECON. J. 683, 684 (1965).

20. *See id.*

21. *See* Sunstein, *supra* note 3, at 386 (citing STEPHEN BREYER ET AL., ADMINISTRATIVE LAW AND REGULATORY POLICY 120-35 (5th ed. 2002); Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136(bb) (2000); Toxic Substances Control Act, 15 U.S.C. § 2605(c)(1) (2000); Safe Drinking Water Act, 42 U.S.C. § 300g-1(b)(3)(c) (2000)).

22. Presidents Carter, Reagan, and Clinton have signed executive orders concerning CBA. Exec. Order No. 12,044, 43 Fed. Reg. 12,661 (Mar. 24, 1978); Exec. Order No. 12,291, 46 Fed. Reg. 13,193 (Feb, 19, 1981); Exec. Order No. 12,866, 58 Fed. Reg. 51,735 (Oct. 4, 1993).

benefits and are feasible.[23] Many costs and benefits are not, however, readily expressed in dollars and cents.

As noted above, countless government programs prevent premature deaths. The EPA's National Ambient Air Quality Standards (NAAQS), for example, establish acceptable levels of air pollutants throughout the United States.[24] These standards force polluters to reduce their emissions of potentially lethal toxins such as lead, carbon monoxide, and particulate matter ($PM_{2.5}$). By tightening $PM_{2.5}$ standards 20 percent over the next decade,[25] the EPA will prevent up to 7,100 premature deaths *per year*.[26] Nevertheless, tighter air quality standards impose costs on activities that produce $PM_{2.5}$, including automobile operation and power generation. In evaluating such regulations, cost-benefit analysts must assign an explicit value to the benefits of premature death prevention. Otherwise, they implicitly assign it a value of zero. The value of human life is, understandably, difficult to quantify.

Until the 1960s, the value of life was estimated based on the discounted sum of expected future income.[27] Although such values are still used to determine compensation in wrongful death lawsuits,[28]

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23. Although cost-benefit comparisons may seem noncontroversial, numerous critics have attacked CBA. Much of the debate centers on the notion of potential Pareto improvements. According to this concept, one resource allocation is preferable to another if "the gainers from change are hypothetically able to compensate those who lose." MIT DICTIONARY, *supra* note 11, at 338. Many reject potential Pareto improvements as valid efficiency measures. *See* John M. Gowdy, *The Revolution in Welfare Economics and Its Implications for Environmental Valuation and Policy*, 80 LAND ECON. 238, 242-45 (2004) (citing T. Scitovsky, *Note on Welfare Propositions in Economics*, 9 REV. ECON. STUD. 77 (1941)) (claiming that it is not necessarily possible to prove that one allocation is unequivocally preferable to another); FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING 34-35 (2004) (criticizing the idea that gainers are not required to compensate losers); Lisa Heinzerling, *Discounting Life*, 108 YALE L.J. 1911 (1999) (noting that the principle of non-compensation is especially troubling when the gains come now and the losses come far in the future, as is the case with policies concerning climate change or nuclear waste storage).

24. U.S. EPA, 2008 NATIONAL AMBIENT AIR QUALITY STANDARDS FOR GROUND-LEVEL OZONE, EXECUTIVE SUMMARY, 1 (2008), *available at* http://www.epa.gov/ttnecas1/regdata/RIAs/0-ozoneriaexecsum.pdf.

25. A 20-percent reduction would imply that permissible PM2.5 levels are lowered from the current standard of 0.84 parts per million to 0.65 parts per million. *See id.* at ES-5.

26. *Id.* at ES-6.

27. *See, e.g.*, Dorothy P. Rice & Barbara S. Cooper, *The Economic Value of Human Life*, 57 AM. J. PUB. HEALTH 1954, 1955 (1967).

28. *See generally* W. Cris Lewis & Tyler J. Bowles, *Assessing Economic Damages in Personal Injury and Wrongful Death Litigation: The State of Utah*, 18 J. FORENSIC ECON. 227 (2006); Tyler J. Bowles et al., *Assessing Economic Damages in Personal Injury and Wrongful Death Litigation: The State of Idaho*, 17 J. FORENSIC ECON. 415 (2005).

economists realized that this approach is not consistent with the standard economic concept of value.[29]

A. Economic Value and the Value of Identified Lives

In neoclassical economic theory, WTP determines the value or benefits of an action. The economic value of John Doe's life is the sum of society's WTP to prevent his death.[30] Valuing *actual* lives using the WTP approach is difficult and perhaps meaningless. How much are people willing to pay to prevent their children's deaths? Most parents would forfeit everything they own. Alternatively, how much must people be paid to accept death? For most, a suitable number does not exist.[31] The irreversibility of death makes it nearly impossible to value. Due to these difficulties, some economists feel that life should not be valued holistically.[32] Indeed, current life-valuation attempts apply a piecemeal approach first proposed by economist Gary Fromm in 1965.[33]

Fromm argued that lives could be valued by observing people's behaviors towards small changes in risk: "[Because people] expose themselves to danger in their avocations...for personal gain...[they] implicitly assign a value to their lives."[34] According to Fromm's example, if the probability of dying on a commercial airplane is 1.7 in 1,000,000 and passengers are willing to pay $0.68 to eliminate this risk, they value their lives at $400,000 ($0.68 divided by 0.0000017).[35]

Fromm's claim notwithstanding, this approach cannot value specific lives because it requires the spurious assumption that people regard symmetric risk reductions equally, regardless of initial risk levels. In reality, WTP varies according to the quantity of risk *and* baseline risk levels.[36] Though a person will pay $100 for a 0.01 percent risk reduction,

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29. E.J. Mishan, *Evaluation of Life and Limb: A Theoretical Approach*, 79 J. POL. ECON. 687, 689-90 (1971) (claiming that "most writers have mental reservations about [the discounted-sum approach's] validity and tend to regard it as only part of the total measurement").

30. *But see* ACKERMAN & HEINZERLING, *supra* note 23 (positing that life is valueless; therefore, it is inappropriate to assign life a specific value); STEVEN KELMAN, WHAT PRICE INCENTIVES? ECONOMISTS AND THE ENVIRONMENT (1981).

31. *See, e.g.*, W. Michael Hanemann, *Willingness to Pay and Willingness to Accept: How Much Can They Differ?* 81 AM. ECON. REV. 635 (1991) (positing that finite WTP values are compatible with infinite willingness-to-be-paid values if substitutes are scarce or nonexistent).

32. *See, e.g.*, VISCUSI, *supra* note 9, at 19.

33. Gary Fromm, *Civil Aviation Expenditures*, *in* MEASURING BENEFITS OF GOVERNMENT INVESTMENT 172 (Robert Dorfman ed., 1965).

34. *Id.* at 193.

35. *Id.* at 194.

36. *See* Alberini, *supra* note 4, at 799.

she may not pay $200 for a 0.02 percent reduction; the additional 0.01 percent reduction may be worth more or less than $100. Yet Fromm's approach requires this supposition. As Professor Mishan later noted, "The implied assumption of linearity, which has it that a man who accepts $100,000 for an assignment offering him a four-to-one chance of survival will agree to go to certain death for $500,000, is implausible, to say the least."[37] In fact, Fromm himself later criticized another economist for relying on the same mistaken assumption.[38] (He did not, however, acknowledge that he had committed the same error three years prior.) This method cannot value *identified* lives. Nevertheless, economists have successfully used this approach to value *unidentified* or statistical lives.

B. The Value of Statistical Life

Risk mitigation policies prevent deaths that are anonymous, at least *ex ante*. The EPA cannot identify the 7,100 people whose lives will be spared through tighter air quality standards.[39] This knowledge might be available *ex post*, but such information is not accessible as decisions are made. However, as Professor Mitchell has stated, "The principle of consumer sovereignty suggests that policymakers should attempt to implement the current desires of the public—clearly an objective with an *ex ante* perspective."[40] According to this viewpoint, the value of preventing unidentified deaths, not the value of preventing any specific person's death, is relevant to expenditure decisions.[41]

Reductions in wide-ranging mortality risks result in reductions in anonymous deaths. Consequently, if it is possible to determine society's WTP for risk reductions, it is possible to estimate the benefits of reductions in anonymous deaths. This is the purpose of the value of statistical life, which "is the rate at which individuals are prepared to trade off income for risk reductions...[and] is, therefore, a derivate."[42] *The value of statistical life is society's equilibrium income-risk exchange rate.* It does not, strictly speaking, define the benefits of preventing a single

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37. Mishan, *supra* note 29, at 691.

38. Gary Fromm, *Comment on T. C. Schelling's Paper "The Life You Save May Be Your Own", in* PROBLEMS IN PUBLIC EXPENDITURE 166, 174 (1968).

39. *See supra* note 26 and accompanying text.

40. ROBERT C. MITCHELL, USING SURVEYS TO VALUE PUBLIC GOODS: THE CONTINGENT VALUATION METHOD 30 (1989) (emphasis added).

41. *But see* ACKERMAN & HEINZERLING, *supra* note 23, at 68 (arguing that the benefits of risk-reduction programs should be measured according to the value of general risk reductions, an *ex ante* perspective, and the value of actual lives saved, an *ex post* perspective).

42. Alberini, *supra* note 4, at 784.

death; it merely provides an estimate. Emphasizing this point, Professor Sunstein recently stated, "there is no 'value of a statistical life'; there are only values for the reduction of statistical risks."[43]

In practice, however, the value of statistical life is not a derivate: it is the ratio of WTP for a specific risk reduction to the absolute level of reduction.[44] For example, in a recent study, participants were willing to pay $1,589.46 for a 0.05 percent reduction in the probability of death.[45] According to these results, the estimated value of statistical life is $3.179 million.[46]

I have included the calculations deriving the standard value of statistical life in the Appendix, but there are three important theoretical implications I would like to discuss here. First, the relationship between the value of statistical life and income is positive. As income increases, people attach a higher value to safety improvements. Nearly all value-of-statistical-life studies confirm this correlation.[47] EPA accordingly adjusts the value of statistical life to account for expected income growth.[48]

Second, because WTP varies according to the overall probability of death,[49] the value of statistical life is a function of baseline risk levels.[50] The relationship between the value of statistical life and the overall probability of death is positive. In CBA, policymakers typically ignore initial risk levels. Although this tendency is undesirable, most government programs deal with remote mortality risks. For this reason, Professor Viscusi argues that the value of statistical life should be used only to estimate the benefits of small changes in minute death probabilities.[51]

Finally, as noted in the Appendix, the standard value-of-statistical-life derivation assumes that personal welfare is solely a function of income. Consequently, the well-being of others does not influence personal welfare. This implicitly accepts the anti-altruism assumptions mentioned in Part I: either altruism does not exist or it

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43. Sunstein, *supra* note 3, at 392.

44. Alberini, *supra* note 4, at 784.

45. Anna Alberini et al., *Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?* 32 J. RISK & UNCERTAINTY 231, 241 (2006).

46. $1,589.46/0.0005 = $3.179 million. *Id.* at 243.

47. *See, e.g.*, VISCUSI, *supra* note 9; Kevin L. Brady, *An Expressed Preference Determination of College Students' Valuation of Statistical Lives: Methods and Implications*, 42 COLLEGE STUDENT J. 968 (2008).

48. *See, e.g.*, U.S. EPA, 2008 NATIONAL AMBIENT AIR QUALITY STANDARDS FOR GROUND-LEVEL OZONE, ch. 6, at 25 (2008), *available at* http://www.epa.gov/ttnecas1/regdata/RIAs/6-ozoneriachapter6.pdf.

49. *See supra* text accompanying notes 36–38.

50. *See infra* Appendix.

51. VISCUSI, *supra* note 9, at 20.

should be ignored. Most risk researchers follow the standard model; they eschew altruism. For example, despite the existence of four risk WTP estimation methods,[52] most researchers primarily rely on two WTP elicitation techniques: compensating wage studies[53] and contingent valuation.[54] The first approach determines the amount of income necessary to convince workers to accept increased on-the-job health risks. For example, elephant handlers at the Philadelphia Zoo receive an extra $1,000 per year because of the dangerous nature of their job.[55] These wage differentials necessarily reveal attitudes toward changes in risk that are exclusively private. Contingent valuation studies, which use surveys to directly ask consumers how much they are willing to pay for a certain good, are capable of revealing preferences toward public risks.[56] However, survey administrators typically instruct respondents to consider private risks only. In a recent study, researchers directed participants to "report information about their WTP for...risk reductions," instructing respondents "to think of [the] risk as their own."[57] Both methods primarily estimate WTP for reductions in *private* risks. And, as noted above, government agencies use these estimates to compute the value of statistical life and thereby determine the benefits of *public* risk reductions. To demonstrate this point, it may be useful to examine the origins of common value-of-statistical-life estimates.

The EPA's value-of-statistical-life estimate is based on Professor Viscusi's 1993 study.[58] This estimate relies on 26 wage differential studies and five contingent valuation surveys.[59] Adjusted for inflation, these 31 studies provide a mean value of statistical life of $6.1 million.[60] Accordingly, recent EPA studies attribute roughly $6 million to the value of

52. Alberini, *supra* note 4, at 783.

53. *See, e.g.*, Michael J. Moore & W. Kip Viscusi, *The Quantity-adjusted Value of Life*, 26 ECON. INQUIRY 386 (1988); Robert S. Smith, *Compensating Wage Differentials and Public Policy: A Review*, 32 IND. & LAB. RELATIONS REV. 339 (1979); PETER DORMAN, MARKETS AND MORTALITY: ECONOMICS, DANGEROUS WORK, AND THE VALUE OF HUMAN LIFE (1996).

54. *See, e.g.*, Alberini et al., *supra* note 45; Alberini, *supra* note 4; Phaedra S. Corso et al., *Valuing Mortality Risk Reduction: Using Visual Aids to Improve the Validity of Contingent Valuation*, 23 J. RISK & UNCERTAINTY 165 (2001); James K. Hammitt & John D. Graham, *Willingness to Pay for Health Protection: Inadequate Sensitivity to Probability?*, 18 J. RISK & UNCERTAINTY 33 (1999); Brady, *supra* note 47.

55. VISCUSI, *supra* note 9, at 8.

56. Per-Olov Johansson, *Altruism and the Value of Statistical Life: Empirical Implications*, 13 J. HEALTH ECON. 111 (1994).

57. Alberini et al., *supra* note 45, at 235.

58. W. Kip Viscusi, *The Value of Risks to Life and Health*, 31 J. ECON. LIT. 1912 (1993).

59. U.S. EPA, *supra* note 5.

60. *Id.*

unidentified death prevention.[61] The Federal Food and Drug Administration's value of statistical life is comparable to EPA's estimate.[62] Other major government agencies similarly value statistical lives in the range of $5 to $6 million dollars.[63] If both anti-altruism assumptions are correct, these numbers are *not* accurate estimates of the value of anonymous death prevention because they rely solely on private WTP values.

III. THE ABSENCE OF ALTRUISM

I am not the first writer to note the absence of altruism in value-of-statistical-life calculations. Professor Mishan observed in the 1970s that the value of a person's life is equal to her private WTP to prevent her own death *plus* all others' WTP to prevent her death.[64] Twenty years later, Professor Viscusi commented, "The extent and implications of altruistic concerns have yet to be estimated properly."[65] By this time, researchers had begun to seriously investigate the potential role of altruism.[66] Nevertheless, their results were never incorporated into policy decisions. In 2004, economist Frank Ackerman and law professor Lisa Heinzerling asked the critical question, "How much is it worth to you to prevent the death of an unknown person far away?...The answer cannot be deduced solely from your attitudes toward risks to yourself."[67]

A. Does Altruism Exist?

1. *Casual Observations*

Anecdotal evidence suggests that people are willing to sacrifice to prevent the deaths of others. In August 2007, six coal miners were trapped underground by a partial cave-in at the Crandall Canyon

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61. *See, e.g.*, Sunstein, *supra* note 3, at 397.

62. *See, e.g.*, Beverages: Bottled Water Arsenic Standards, 69 Fed. Reg. 70,082 (proposed Dec. 2, 2004) (codified at 21 C.F.R. pt. 165) (stating that the Federal Food and Drug Administration "used a range of $5 to $6.5 million for the value of a statistical life...This range includes the VSL of $6.1 million that EPA used in their analysis").

63. *See, e.g.*, Sunstein, *supra* note 3, at 396–98. *But see* Memorandum from Kirk K. Van Tine, Gen. Counsel & Linda Lawson, Acting Deputy Assistant Sec'y for Transp. Pol'y, U.S. Dep't of Transp. (Jan. 29, 2002), *available at* http://ostpxweb.dot.gov/policy/Data/VSL02guid.pdf (encouraging the Department of Transportation to use three million dollars as the value of life).

64. Mishan, *supra* note 29, at 198–201.

65. VISCUSI, *supra* note 9, at 21.

66. *See infra* Part III.B.2.

67. ACKERMAN & HEINZERLING, *supra* note 23, at 69–70.

Mine.[68] Because communications were cut off, administrators did not know if those in the mine had survived the initial collapse. Many people sacrificed time and money in a heroic effort to save the miners. Unfortunately, these attempts were ultimately unsuccessful and three additional rescue workers perished.[69] Those involved in the rescue efforts knew the identity of the trapped miners. The rescue workers revealed a conspicuous WTP to prevent their deaths.

Similarly, parents accept lower salaries in exchange for medical insurance benefits that extend to their children. It seems unreasonable to suggest that parental welfare is not affected by the well-being of their children. As noted above, however, most risk-reduction policies prevent the deaths of persons that are unknown. Thus, the willingness to sacrifice displayed by rescue workers and affectionate parents, both of whom have an *ex post* perspective, does not provide a relevant estimate of the value of preventing the deaths of unidentified persons, nor does it demonstrate that people are indeed willing to pay for risk reductions enjoyed by unknown persons. Therefore, before including this sort of altruism in value-of-statistical-life calculations, we must ask, Does altruism exist even if it is impossible to identify whose deaths, if any, will be prevented through risk-reduction programs?

Americans donated over 15 million units of blood in 2004.[70] Most people give one unit of blood per donation. Americans therefore donated blood on approximately 15 million occasions in 2004. Of these donations, only 132,000 were designated for specific patients;[71] all others were made without knowledge of the eventual beneficiary. Although the motivations for donating blood may be complex,[72] anonymous blood donations provide a clear answer to the previous question: people *are* willing to pay to prevent the premature death of others, even if such persons remain unidentified. Still, much of the existing empirical data is conflicting; as I discuss below, some results are entirely paradoxical.

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68. Dan Frosh & Jennifer Lee, *Rescue Halted at Mine After 3 Deaths and 6 Injuries*, N.Y. TIMES, Aug. 17, 2007, http://www.nytimes.com/2007/08/17/us/17cnd-mine.html?_r=2&hp&oref=slogin&oref=slogin.

69. *Id.*

70. BARBEE WHITAKER & MARIAN SULLIVAN, DEP'T OF HEALTH & HUMAN SERVICES, THE 2005 NATIONWIDE BLOOD COLLECTION AND UTILIZATION SURVEY REPORT 13 (2005), *available at* http://www.hhs.gov/bloodsafety/2005NBCUS.pdf.

71. *Id.* at 19.

72. *See, e.g.*, Shalom H. Schwartz, *Normative Explanations of Helping Behavior: A Critique, Proposal, and Empirical Test*, 9 J. EXPERIMENTAL SOC. PSYCH. 349 (1973) (arguing that people's willingness to donate blood is a function of the perceived moral obligation).

2. Empirical Evidence

If altruism exists, consumers' WTP for public safety improvements should exceed their WTP for equivalent private improvements. A group of economists recently examined 96 empirical estimates of WTP, most of which were elicited using contingent valuation surveys.[73] According to their study, consumers are willing to pay *more* for private risk reductions than public reductions.[74] These results imply that, given the choice between (a) safety improvements that strictly apply to the individual, and (b) equivalent improvements that apply to the individual and all others (including family members and friends), the average person would select the former. In other words, people are misanthropists, not altruists. Individual welfare increases as others experience an increased risk of death! There are a few possible explanations for this counterintuitive empirical result.

First, respondents who stated their WTP for risk reduction as a private good are not the same participants who expressed WTP for risk reduction as a public good. In fact, private and public risk surveys may bear little resemble to one another.[75] It is therefore questionable whether the WTP values are directly comparable. After all, "[s]mall changes in question wording...sometimes cause significant changes in survey responses."[76] This does not explain similar disparities in studies where participants received near-identical surveys.[77] However, improper survey design may also lead to paradoxical results.

Researchers should urge survey participants to *endogenously* consider public risks. If participants do not apply the implications of risks to themselves, WTP bids may be vastly understated. Many surveys fail in this regard. For example, in a recent study, researchers explicitly stated that private risk programs would decrease the participants' probability of dying.[78] The same researchers equivocally explained the

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73. Arianne de Blaeij et al., *The Value of Statistical Life in Road Safety: A Meta-analysis*, 35 ACCIDENT ANALYSIS & PREVENTION 973 (2003).

74. *Id.* at 980.

75. *See, e.g., id.* (examining 20 public-risk WTP estimates and 75 private-risk WTP estimates, most of which were derived using different surveys).

76. W. Michael Hanemann, *Valuing the Environment Through Contingent Valuation*, 8 J. ECON. PERSPECTIVES 19, 26 (1994).

77. *See, e.g.*, Magnus Johannesson et al., *The Value of Private Safety Versus the Value of Public Safety*, 13 J. RISK & UNCERTAINTY 263 (1996) (finding that public WTP is less than private WTP for road safety programs); Lars Hultkrantz et al., *The Value of Improved Road Safety*, 32 J. RISK & UNCERTAINTY 151 (2006).

78. The following private risk-reduction scenario was used:

> Consider that a traffic safety device is developed which can reduce serious accidents. It can fully prevent fatal and severe injury risk for the users of

effects of the public risk-reduction program; they did not encourage participants to apply the effects of the risk reduction to themselves.[79] Respondents may have therefore considered the public program primarily as an improvement in the safety of others. In this study, the sum of private and public WTP values more accurately reflects the altruism-adjusted value of life.[80]

The original group of economists proposed a final explanation: WTP for public risk reduction is subject to the free-rider effect.[81] That is, consumers may strategically understate their true WTP if they expect that others will also pay. In such cases, *stated* public WTP values do not equal *actual* WTP values, so the comparison of private and public WTP numbers is illegitimate.

Flawed surveys therefore appear to be the likeliest explanation for the counterintuitive results, and researchers can eliminate these sources of bias through proper survey design. As expected, studies that mitigate these problems yield empirical evidence supporting the existence of altruism.

Economists Jorge Araña and Carmelo León recently surveyed 700 households to determine their WTP for reductions in the probability of acquiring influenza.[82] The sample was split into two groups. One group stated WTP for a flu vaccine—a private risk reduction; the other group stated WTP for a policy that reduces the overall probability of acquiring flu—a public risk reduction.[83] Both groups were asked to assume the same absolute level of risk reduction. Researchers corrected the first problem because the surveys were identical aside from the specific risk-reduction question. Also, the survey explicitly instructed

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> this equipment within a city, e.g.[,] the urban area of Örebro. Pedestrians, bicyclists and car users can use the device. It reduces the risk for severe accidents within the urban area to zero only for the person that is using it; it can not be used by others, not even within the same household.

Hultkrantz et al., *supra* note 77, at 157.

79. The following public risk-reduction scenario was used:

> [Consider] a road traffic safety programme that will reduce the number of fatal and severe injuries within the urban area of Örebro with 16 persons within the urban area of Örebro during one year. The reduction applies to pedestrians, bicyclists and car users. Outside the urban area the number of road accidents will be unaffected.

Id. at 158.

80. *See, e.g.*, Josephine Borghi, *Aggregation Rules for Cost-Benefit Analysis: A Health Economics Perspective*, HEALTH ECON. ONLINE Doi: 10.1002/Hec.1304 (2007) (examining the value of statistical life under varying WTP aggregation methods).

81. Blaeij et al., *supra* note 73, at 979.

82. Jorge E. Araña & Carmelo J. León, *Willingness to Pay for Health Risk Reduction in the Context of Altruism*, 11 HEALTH ECON. 623, 624 (2002).

83. *Id.* at 625.

participants to endogenously consider public risk reductions.[84] Furthermore, the researchers took steps to mitigate potential free-rider biases.[85] The researchers avoided all three problems mentioned above, and their results complied with expectations. On average, respondents were willing to pay 14 to 24 percent *more* for public morbidity reductions than for private morbidity reductions.[86] These results confirm common intuition: altruism exists. Should policymakers disregard it?

B. Is Altruism Safety-focused?

1. Theory

As noted in the introduction, Professor Bergstrom has cogently argued that policymakers should ignore altruistic concerns.[87] Although consumers are willing to pay to improve the safety of others, he believes that policymakers should not increase safety expenditures. According to Bergstrom, if government agencies were to increase the value of statistical life to account for altruism, taxes would have to be uniformly raised to pay for greater risk-reduction expenditures.[88] The tax increase, however, lowers overall welfare: "If the benefits to Peter of the extra public safety must include Peter's valuation of increased safety for Paul, then the costs to Peter of the taxes that pay for the increased safety must include Peter's regrets for Paul's reduced consumption."[89] If taxes are raised to pay for Peter's altruism, Paul is no longer able to purchase as many goods and Paul's overall welfare decreases. Therefore, the existence of altruism *does not* imply that agencies should increase their estimates of the value of statistical life. Professor Milgrom later concurred with Bergstrom's assessment.[90]

Bergstrom's simple proof may be one of the primary reasons policymakers ignore altruism in current CBAs. Nevertheless, his model relies on a questionable assumption concerning the nature of altruism, namely that it is neutral. Neutral altruism implies that Peter's welfare is affected by Paul's well-being as Paul perceives it, not as Peter perceives it.

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84. *Id.* at 634.

85. *Id.* at 625 (reducing the free-rider problem by including "a provision rule...stressing that the preventive campaign would be carried out only if everybody would agree to pay for the policy").

86. *Id.* at 630.

87. Bergstrom, *supra* note 13.

88. *Id.* at 17.

89. *Id.*

90. Milgrom, *supra* note 14.

In 1991, Professor Jones-Lee expanded Bergstrom's model by considering safety-focused altruism, a form of paternalistic altruism.[91] Altruism is safety-focused if "[Peter's] concern for [Paul's] welfare is solely related to [Paul's] safety and not to other determinants of [Paul's] well-being."[92] In this case, Peter's well-being increases when Paul enjoys greater safety, though it may remain unaffected when Paul's income grows. *If altruism is entirely safety-focused, it is not only appropriate but necessary to include the full amount of people's WTP for the safety of others in the valuation of statistical lives.*[93] Accordingly, current value-of-life estimates are inadequate. The Appendix contains an informal proof of this proposition. Professor Jones-Lee later demonstrated that the degree to which one person's WTP for another's safety should affect risk expenditure decisions depends on the likelihood that altruism deviates from neutrality.[94] He further estimated that the altruism-adjusted value of statistical life is 10 to 40 percent greater than the value used in current policy analyses.[95] This theoretical estimate contains the 14 to 24 percent range found by economists Araña and León.[96]

Professors Bergstrom's and Jones-Lee's conflicting models beg the question: Is altruism neutral or safety-focused? The former implies that policymakers should ignore altruism; the latter implies that policymakers should increase the value of statistical life to account for it. Government welfare programs may offer some insight.

2. Empirical Evidence

If altruism tends to be neutral, one would expect society to pursue aid programs that offer cash payments, for recipients would be free to spend aid money however they please, thereby maximizing personal welfare *as perceived by recipients*. If, on the other hand, altruism is paternalistic, society would pursue spending programs that increase recipients' welfare *as perceived by society at large*. In 2002, cash payments constituted less than 10 percent of total aid given to families.[97] Most government welfare spending instead focused on "Medicaid, food stamps, public housing, school nutrition programs (the National School

91. M.W. Jones-Lee, *Altruism and the Value of Other People's Safety*, 213 J. RISK & UNCERTAINTY 213, 213 (1991).

92. *Id.* at 213–14.

93. *Id.* at 213 (claiming that one person's WTP for another's safety should be *fully* included in the value of statistical life "*if and only if* altruism is exclusively safety-focused").

94. Jones-Lee, *supra* note 18, at 88.

95. *Id.* at 89.

96. Araña & León, *supra* note 82, at 630.

97. Janet Currie, *Cutting the Safety Net One Strand at a Time*, *in* THE ECONOMISTS' VOICE 194, 195 (Joseph E. Stiglitz et al. eds., 2008).

Lunch and the School Breakfast programs), [and] WIC (Supplemental Nutrition for Women, Infants, and Children)...."[98] Because welfare programs center on health and nutrition, current spending levels seem to indicate that altruism is safety-focused. A new empirical study strengthens this proposition.

In 2007, another team of economists conducted a simple survey to test the nature of altruism.[99] The researchers queried 360 students, informing participants they could donate either money or nicotine patches to a poor diabetes patient. According to the hypothetical scenario, the patient's WTP for nicotine patches was less than the market price. The respondents knew that the patient preferred cash payments to nicotine patches. Thus, "[a] pure altruist will...always prefer to donate money," which maximizes the patient's welfare, "whereas a [safety-focused] altruist may prefer to donate nicotine patches,"[100] which improves the patient's health. Ninety percent of participants offered to donate nicotine patches instead of money.[101] The students apparently attempted to improve the patient's health rather than maximize his overall welfare. These results provide strong support for the idea that altruism is safety-focused.

Although further research is certainly encouraged, significant evidence contradicts the anti-altruism assumptions described in Part I of this essay. Not only does altruism exist, but it tends to be safety-focused. Therefore, people are willing to pay to reduce the health risks of others as well as themselves, and these higher WTP values should increase policymakers' estimates of the value of statistical life. In Part IV, I reexamine two recent CBA analyses using estimates of the altruism-adjusted value of statistical life and show how the failure to account for altruism influences which safety programs policymakers implement and the number of deaths thereby prevented.

IV. ALTRUISM IN COST-BENEFIT ANALYSIS

"CBA drives the environmental policy recommendations of most economists,"[102] despite the protests of many.[103] Value-of-statistical-life estimates, which profoundly affect the expected costs and benefits,

98. *Id.* at 196–97.

99. Fredric Jacobsson et al., *Is Altruism Paternalistic?*, 117 ECON. J. 761 (2007).

100. *Id.* at 765.

101. *Id.* at 761.

102. Gowdy, *supra* note 23, at 241.

103. *See, e.g.*, Alan Randall, *Why Benefits and Costs Matter*, 14 CHOICES 38 (1999) (endorsing CBA with specific qualifications, namely that policy decisions should not make decisions solely on the results of CBA).

heavily influence policymakers' attitudes towards various life-saving programs. It is therefore important to know the true value of anonymous death prevention.

In this part, I analyze the CBAs in two recent EPA studies. These particular studies were selected because, first, both examine programs that reduce mortality levels. The EPA's estimate of the value of statistical life therefore plays an important role in each analysis. In addition, in both studies, the costs were found to outweigh the benefits in certain regions or under certain assumptions. As noted in Part III, Professors Araña, León,[104] and Jones-Lee[105] performed studies suggesting that the altruism-adjusted value of life is 10 to 40 percent greater than the value currently used by government agencies.[106] I herein briefly—and somewhat crudely—reevaluate the expected benefits of both programs using this adjustment for altruism. The intent is to demonstrate that the absence of altruism in these calculations can have a determinative impact on which programs are found to be economically feasible.

A. Clean Air Act, Section 126

In standard economics, external diseconomies, often misleadingly referred to simply as externalities, are activities that impose costs on someone other than the producer.[107] Pollution is a classic example. Unless polluters are liable for the costs of contaminated air and water, harmful emissions impose external diseconomies on those who desire a clean environment. Power plants often emit harmful pollutants. One such pollutant is nitrogen oxide (NO_x),[108] a harmful toxin that causes lung damage. Once released into the atmosphere, NO_x can travel via wind to adjoining areas. Congress, through the Clean Air Act, has attempted to mitigate this external diseconomy by establishing ambient NO_x standards.[109]

Several Northeastern states recently filed a petition with the EPA charging that pollution produced in neighboring areas prevented the

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104. Araña & León, *supra* note 82.

105. Jones-Lee, *supra* note 18.

106. *Supra* text accompanying notes 86, 91-96.

107. *See generally* James M. Buchanan & Wm. Craig Stubblebine, *Externality*, 29 ECONOMICA 371 (1962).

108. U.S. EPA, SECTION 126 PETITIONS: FINAL RULE REGULATORY IMPACT ANALYSIS—SUPPLEMENTARY VOLUME: OZONE-RELATED BENEFITS OF REGIONAL NOx EMISSION REDUCTIONS, ch. 1, at 1 (1999), *available at* http://www.epa.gov/ttn/oarpg/t1/reports/c1suppo3.pdf [hereinafter EPA SUPPLEMENTARY VOLUME, ch 1].

109. *See generally* U.S. EPA, REGULATORY IMPACT ANALYSIS FOR THE FINAL SECTION 126 PETITION RULE (1999), *available at* http://www.epa.gov/ttn/oarpg/t1/reports/126fn0.pdf.

petitioning states from achieving acceptable NO_x levels.[110] Section 126 of the Clean Air Act was drafted in response to this petition, enhancing the EPA's ability to clean up significant sources of interstate air pollution.[111] The EPA later analyzed the efficacy of Section 126 by performing a CBA study. According to the EPA's results, roughly 80 percent of the law's benefits are reductions in mortality risks.[112] In fact, the EPA estimated that full compliance with the law could save 200 lives per year.[113] The EPA compared costs and benefits using two methods: the value-of-statistical-life approach and the value-of-statistical-life-years approach. The latter approach is similar to the method discussed throughout this essay; it simply values years of life rather than life itself.[114] The implications of altruism apply equally to both methods. With the standard approach, the EPA estimated that the program yields positive net benefits of $200 million.[115] With the alternative approach, however, the EPA determined that the program yields *negative* net benefits of $300 million.[116] If policymakers accept the alternative approach, they must conclude that the program is economically infeasible.

Nevertheless, if policymakers increase expected benefits by 43 percent, net benefits are *positive* under both approaches.[117] This adjustment for altruism does not differ significantly from Professor Jones-Lee's upper-end recommendation of 40 percent. In this study, the neglect of altruism could have led policymakers to label an otherwise efficient program as economically undesirable. Because the EPA performed this CBA *ex post* and a recent Supreme Court decision indicates that the EPA cannot consider costs in setting air quality standards,[118] the study's results did not affect the decision to enact Section 126. Still, this and the example below demonstrate that altruism can affect the outcome of CBA.

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110. EPA SUPPLEMENTARY VOLUME, ch. 1, *supra* note 108.

111. *Id.*

112. $1,090 million/$1,360 million = 0.8015; U.S. EPA, SECTION 126 PETITIONS: FINAL RULE REGULATORY IMPACT ANALYSIS—SUPPLEMENTARY VOLUME: OZONE-RELATED BENEFITS OF REGIONAL NOx EMISSION REDUCTIONS, ch. 4, at 2, *available at* http://www.epa.gov/ttn/oarpg/t1/reports/c4suppo3.pdf [hereinafter EPA SUPPLEMENTARY VOLUME, ch. 4].

113. *Id.*

114. Economists Moore and Viscusi made the first attempt to value life years; Moore & Viscusi, *supra* note 53, at 373.

115. EPA SUPPLEMENTARY VOLUME, ch. 4, *supra* note 112, at 6.

116. *Id.*

117. ($1,000 million - $700 million)/$700 million = 0.4286; *see id.*

118. EPA SUPPLEMENTARY VOLUME, ch. 1, *supra* note 108. For the Supreme Court decision, see Whitman v. Am. Trucking Ass'ns Inc., 531 U.S. 457 (2001).

B. September 2006 Adjustment in $PM_{2.5}$ Standards

On September 21, 2006, the EPA adjusted ambient $PM_{2.5}$ standards.[119] According to scientific experts, this adjustment will prevent 1,200 to 24,000 deaths.[120] Full attainment is expected to yield $18 to $22 billion net benefits—the variation depends on the discount rate.[121] The EPA separated the results into three geographical areas: East, West, and California. Net benefits are positive in California and Eastern states but *negative* in Western states (excluding California). Although the EPA estimated that tighter standards could prevent 100 to 1,400 deaths in the West,[122] regional costs exceed benefits by $20 to $100 million.[123] This implies that the EPA should not enforce tighter standards in the West. Nevertheless, if the EPA increases its estimate of benefits by 2.5 to 15 percent to account for altruism, net benefits are universally positive, even in the Western region.[124] As with the previous example, the failure to consider altruism determines whether this regulation is labeled efficient or inefficient. The decision to consider or ignore altruism will continue to have, in many situations, a substantive impact on which projects and regulations government agencies pursue.

V. CONCLUSION

Altruism is pervasive in modern society. People care about others, even anonymous persons. Why, then, does contemporaneous economics largely ignore altruism? Economists as far back as Adam Smith have argued that free markets allocate resources more effectively than alternative systems.[125] In the late nineteenth and early twentieth

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119. U.S. EPA, 2006 NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICLE POLLUTION: REGULATORY IMPACT ANALYSIS, EXECUTIVE SUMMARY, ES-1 (2006), *available at* http://www.epa.gov/ttnecas1/regdata/RIAs/Executive%20Summary.pdf.

120. *Id.* at ES-8.

121. U.S. EPA, 2006 NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICLE POLLUTION: REGULATORY IMPACT ANALYSIS, CHAPTER 9, 9-3 (2006), *available at* http://www.epa.gov/ttnecas1/regdata/RIAs/Chapter%209--Comparison%20of%20Costs%20and%20Benefits.pdf [hereinafter EPA 2006, CHAPTER 9].

122. U.S. EPA, 2006 NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICLE POLLUTION: REGULATORY IMPACT ANALYSIS, CHAPTER 5, 5-69 (2006), *available at* http://www.epa.gov/ttnecas1/regdata/RIAs/Chapter%205--Benefits.pdf.

123. EPA 2006, Chapter 9, *supra* note 121.

124. *Id.*

125. *See, e.g.*, ADAM SMITH, THE WEALTH OF NATIONS 572 (Bantam Classic 2003) (1776) ("As every individual...labours...[h]e intends only his own gain...and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his

century, economists—many of whom went on to receive Nobel Prizes—developed mathematical proofs and theorems that demonstrate the superiority of free markets.[126] These proofs, however, depend on a number of assumptions about consumer preferences. One such assumption stipulates that the well-being of others does not affect personal welfare.[127] Under this assumption, altruism does not exist. If the well-being of others does in fact affect personal welfare, free market allocations are not necessarily optimal. The neglect of altruism is thus rooted in the fundamental theories of microeconomics.

However, given the important distinction between neutral and safety-focused altruism, it makes sense to ignore altruism in many regulatory decisions. As Professor Bergstrom demonstrated, if altruistic concerns are absolutely neutral, it is not wise to increase the value of certain commodities to adjust for altruism, at least in the context of government policy.[128] Perhaps a brief, final example will illuminate this point. Assume Peter is a neutral altruist who wishes to pay so that Paul has better access to the Grand Canyon. Paul, however, has little desire to visit the Grand Canyon. An improvement in road conditions to accommodate for Peter's altruistic feelings would be undesirable for both Peter and Paul: Paul, because he does not wish to see the Grand Canyon, would prefer a cash payment in lieu of better roads, and Peter, who is a neutral altruist, would prefer the action that maximizes Paul's welfare as it is perceived by Paul. In this sort of situation, government policies need not account for any altruistic concerns.

By contrast, it appears that altruism is not neutral in the context of safety improvements. Nobel laureate Kenneth Arrow articulated this idea in the 1960s: "The taste for improving the health of others appears to be stronger than for improving other aspects of their welfare."[129] Such

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intention...By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.").

126. Professors Kenneth Arrow and John Hicks received the Nobel Prize in 1972 "for their pioneering contributions to general economic equilibrium theory and welfare theory." Press Release, The Royal Swedish Academy of Sciences, The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1972 (Oct. 25, 1972), http://nobelprize.org/nobel_prizes/economics/laureates/1972/press.html). Professor Gérard Debreu received the Nobel Prize in 1983 "for his rigorous reformulation of the theory of general equilibrium." Press Release, The Royal Swedish Academy of Sciences, The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1983 (Oct. 17, 1983), http://nobelprize.org/nobel_ prizes/economics/laureates/1983/press.html.

127. *See* HAL R. VARIAN, INTERMEDIATE MICROECONOMIC ANALYSIS: A MODERN APPROACH 561–64 (5th ed. 1999).

128. *See supra* note 13 and accompanying text.

129. Kenneth J. Arrow, *Uncertainty and the Welfare Economics of Medical Care*, 53 AM. ECON. REV. 941, 954 (1963).

altruism is paternalistically safety-focused. In the case of safety-focused altruism, Professor Jones-Lee demonstrated that policymakers should increase expenditures on safety programs to account for altruistic concerns.[130] Empirical tests have yielded ambivalent results, such that further research is warranted. Still, the existing evidence supporting the notion of safety-focused altruism seems to be stronger than the evidence against it. Professor Jacobsson and associates' 2007 study provides the clearest confirmation of safety-focused altruism to date.[131]

Minute mortality risks lead to actual deaths. People die from lung cancer because, in many areas, pollution levels are too high. Unfortunately, decisions concerning the loss of human life are irreversible. No person can serve as a perfect substitute for another. Thus, the tendency to ignore altruism may lead to inefficient levels of irreversible outcomes. One implication is clear: decision makers should be cautious.[132] The costs of overestimating the value of life are preferable to the costs of underestimating it.

I therefore advocate increasing the value of statistical life to account for altruism. Future research will hopefully define the requisite adjustment more precisely. Until then, Professor Jones-Lee's estimate of 10 to 40 percent serves as an excellent starting point. This recommended increase implies that the EPA's value of statistical life should be $6.7 to $8.5 million, not $6.1 million. Properly accounting for the actual value people place on each other's lives as well as their own will alter many environmental and public health CBAs in favor of regulation and will prevent unnecessary deaths.

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130. Jones-Lee, *supra* note 91, at 213.

131. Jacobsson et al., *supra* note 99.

132. *See, e.g.*, Michael C. Farmer & Alan Randall, *The Rationality of a Safe Minimum Standard*, 74 LAND ECON. 287 (1998) ("adherence to standard practices when an irreversible event is threatened is itself an overly rigid, restrictive, and inconsistent policy program"); John V. Krutilla, *Conservation Reconsidered*, 57 AM. ECON. REV. 777, 779–80 (1967) (stating that "maximum willingness to pay...may be significantly less than the minimum which would be required to compensate such individuals were they to be deprived in perpetuity of the opportunity to continue enjoying the natural phenomenon in question" if decisions are irreversible).

APPENDIX

In this section, I derive two definitions of the value of statistical life (VSL) using various assumptions about the nature of altruism. Section A assumes altruism does not exist—consumers are purely self-interested. Section B assumes that altruism is entirely safety-focused. As demonstrated below, the assumption of safety-focused altruism implies a greater VSL and justifies higher levels of safety expenditures.

A. No Altruism

Theoretical definitions of VSL are often derived using the concept of expected utility.[133] Consumers attempt to maximize expected utility, or welfare, subject to personal budget constraints. Let E_1^{SI} be the expected utility of Person 1, a purely self-interested individual, and p_1 his probability of death. E_1^{SI} is a quasi-concave, twice differentiable function. Further, let $U_1^{SI}(c_1)$ be the utility of Person 1 associated with consumption c_1 if he is living and $V_1^{SI}(c_1)$ the utility of consumption if he is dead.

$$E_1^{SI} = (1-p_1)\cdot U_1^{SI}(c_1) + p_1 \cdot V_1^{SI}(c_1).$$

Assuming that the post-mortality utility of consumption is zero, expected utility can be restated in the following manner:

$$E_1^{SI} = (1-p_1)\cdot U_1^{SI}(c_1). \quad (1)$$

Person 1 faces an income constraint of M_1, which can be spent on consumption or safety improvements:

$$M_1 = c_1 + TWTP_1^{SI}(p_1), \quad (2)$$

where $TWTP_1^{SI}(p_1)$ is Person 1's total willingness to pay for the level of risk. By definition, $VSL = |dM/dp|$. Thus, $VSL = |dTWTP_1^{SI}(p_1)/dp_1|$ because $|dM/dp_1| = |dTWTP_1^{SI}(p_1)/dp_1|$ (from Equation 2).

Setting up the Lagrangean

$$\ell^{SI} = (1-p_1)\cdot U_1^{SI}(c_1) + \lambda\cdot(M_1 - c_1 - TWTP_1^{SI}(p_1)), \quad (3)$$

133. *See, e.g.*, Sherwin Rosen, *The Value of Changes in Life Expectancy*, 1 J. RISK & UNCERTAINTY 285, 286 (1988); Alberini, *supra* note 4, at 784; Alberini et al., *supra* note 45, at 232.

yields the following first-order conditions, where λ is the Lagrangean multiplier:

$$\ell^{SI}_{c_1} = dU_1^{SI}/dc_1 - p_1 \cdot dU_1^{SI}/dc_1 - \lambda = 0,$$
$$\ell^{SI}_{p_1} = -U_1^{SI} - \lambda \cdot dTWTP_1^{SI}/dp_1 = 0. \quad (4)$$

Therefore,

$$VSL_1^{SI} = \left|dTWTP_1^{SI}/dp_1\right| = \frac{U_1^{SI}}{(1-p_1)\cdot dU_1^{SI}/dc_1}.^{134} \quad (5)$$

Equation 5 expresses VSL under the assumption that Person 1 is purely self-interested. This assumption is contained in Equation 1, which posits that expected utility is exclusively a function of personal consumption and private mortality risk levels. As noted in the text, government agencies value public safety improvements with private WTP estimates.[135] Agencies therefore implicitly adopt Equation 1's assumptions. Accordingly, Equation 5 defines the value of statistical life as it is currently used in CBA.

B. Safety-focused Altruism

The VSL for safety-focused altruists is derived in a similar manner. This section assumes that Person 1 is a safety-focused altruist. Therefore, improvements in the safety of others increase his expected utility:

$$E_1^{SA} = (1-p_1)\cdot U_1^{SA}(c_1, p_2, ..., p_n). \quad (6)$$

where U_1^{SA} is a non-increasing function of n persons' death probability, and n is the number of people in society.

Setting up the Lagrangean

$$\ell^{SA} = (1-p_1)\cdot U_1^{SA}(c_1, p_2, ..., p_n) + \lambda \cdot (M_1 - c_1 - TWTP_1^{SA}(p_1, ..., p_n)), \quad (7)$$

134. *C.f.* Alberini, *supra* note 4, at 784 (deriving the value of statistical by implicitly differentiating Equation 1 rather than imposing the budget constraint in Equation 2).

135. *Supra* text accompanying notes 52–63.

yields[136] the following VSL:

$$VSL_1^{SA} = \left| \sum_{i=1}^{n} dTWTP_1^{SA} / dp_i \right| = \frac{U_1^{SA}}{(1-p_1) \cdot \partial U_1^{SA} / \partial c_1} - \frac{\sum_{i=2}^{n} \partial U_1^{SA} / \partial p_i}{\partial U_1^{SA} / \partial c_1}. \quad (8)$$

By assumption, Person 1 is a safety-focused altruist, so

$$-\frac{\sum_{i=2}^{n} \partial U_1^{SA} / \partial p_i}{\partial U_1^{SA} / \partial c_1} > 0.$$

Person 1's utility decreases as the death risk of others increases. As a result, VSL^{SA} (from Equation 8) is greater than VSL^{SI} (from Equation 5), since $dU_1^{SI}/dc_1 = \partial U_1^{SA}/\partial dc_1$.[137] This demonstrates that VSL is greater under the assumption of safety-focused altruism than under the assumption of no altruism, since the second part of Equation 8 would be positive for an altruist and zero for someone purely self-interested. Equation 8 defines the value of statistical life that *should* be used in CBA if consumers are safety-focused altruists. As noted in the text, Professor Jones-Lee estimates that Equation 8 is 10 to 40 percent larger than Equation 5.[138]

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136. The first-order conditions are
$\ell_{c_1}^{SA} = \partial U_1^{SA} / \partial c_1 - p_1 \cdot \partial U_1^{SA} / \partial c_1 - \lambda = 0$, and

$$\ell_{p_i}^{SA} = \sum_{i=2}^{n} \partial U_1^{SA} / \partial p_i - U_1^{SA} - p_1 \cdot \sum_{i=2}^{n} \partial U_1^{SA} / \partial p_i - \lambda \cdot \sum_{i=1}^{n} dTWTP_1^{SA} / dp_i = 0.$$

137. For any person, government agencies' allowance (Equation 6) or disallowance (Equation 1) of altruism does not affect the marginal utility of personal consumption, so $dU_1^{SI}/dc_1 = \partial U_1^{SA}/\partial dc_1$.

138. *Supra* text accompanying notes 91–96.