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# Tinkering with the Machinery of Life

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## ABSTRACT

Recent adjustments by the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) to their cost–benefit analysis procedures could cause tremendous changes to federal regulation. For decades, federal agencies have calculated the value of a statistical life (VSL) and have used that number when evaluating the costs and benefits of proposed regulations. If a regulation was expected to save lives, the number of lives saved could be multiplied by the VSL to monetize the benefits. Because, however, lives saved in the future were given the same nominal value as lives saved in the present, the real value of future lives was substantially eroded by discounting to present value, generally at annual rates of 3 and 7 percent. In other words, if a life saved today is worth $8 million, a life saved in ten or twenty years would be worth far less. A discount rate of 7 percent erodes half the value of a life expected to be saved in 2022 and three-quarters of one expected to be saved in 2032. This process hinders the regulation of slow-acting perils, such as workplace carcinogens and global climate change.

Now the EPA and the DOT have begun inflating VSLs when calculating the benefits of regulations. Before subjecting lifesaving benefits to the same discounting applied to other costs and benefits, the agencies adjust the values upward to reflect the expected higher income (and associated willingness to pay to avoid risks of harm) enjoyed by future persons. This seemingly minor procedural change can radically alter the expected benefits of major regulations, and the regulated community will likely oppose the agencies' efforts to more accurately calculate future benefits. Observers of federal regulation should track this battle carefully and contact other federal agencies as they decide whether to adopt the "VSL inflation" procedure.

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Without much fanfare, at least two federal agencies—the Department of Transportation (DOT) and the Environmental Protection Agency (EPA)—have recently made changes to their cost–benefit analysis procedures. The changes are technical and may not seem especially exciting, even to those predisposed to read regulatory impact analyses. But they have the potential to affect substantive regulations important to every American, covering matters as varied as vehicle emissions standards, water pollution limits, airline flight crew rest requirements, transportation of radioactive waste, and pesticide use. The procedural changes have such broad effects because they alter a calculation at the heart of regulations protecting the environment and human safety: the value of human life. Because many regulations are designed to save lives, the value assigned to life largely determines expected regulatory benefits, a projection that influences the robustness of a proposed regulation and the likelihood of its eventual enactment.[1]

Put simply, the DOT and the EPA have changed their methods of calculating the values of human lives expected to be saved by regulations. Until recently, pursuant to the standard practice in the executive branch, both agencies valued a life saved in the future as equal to a life saved today.[2] Because future costs and benefits of regulations were discounted to their present value, however, the practical effect of this nominal equality was that future lives were worth less than current lives, and the further into the future a life was projected to be saved, the less importance was given to the life when weighing the costs and benefits of a proposed regulation.[3] For example, if a workplace safety regulation would decrease worker contact with a certain carcinogen, the expected benefit (preventing worker cancer deaths) would be discounted to its present value based on when the prevented deaths otherwise would have occurred. Assuming an annual discount rate of 3 percent, a life saved in 2022 would be deemed about three-quarters as valuable as one saved today,[4] while a

1. Federal law requires agencies to conduct a cost–benefit analysis before promulgating major regulations, and assigning a value to saved lives is essential to setting a monetary value on the benefits of lifesaving regulations. *See* Exec. Order No. 12,866, 3 C.F.R. 638 (1994), *reprinted as amended in* 5 U.S.C. § 601 (2006); Richard L. Revesz, *Environmental Regulation, Cost-Benefit Analysis, and the Discounting of Human Lives*, 99 COLUM. L. REV. 941, 955–57 (1999).

2. *See* Frank Ackerman & Lisa Heinzerling, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, 150 U. PA. L. REV. 1553 (2002).

3. *See* Douglas A. Kysar, *Discounting . . . on Stilts*, 74 U. CHI. L. REV. 119, 131–35 (2007).

4. The present value (PV) of a future benefit is given by the formula $PV = FV/(1 + r)^n$, where FV represents future value, r represents the annual discount rate, and n represents the number of years into the future that the benefit will be received. Thus, assuming a 3 percent discount rate, a future

life saved in 2032 would be deemed about 55 percent as valuable as a 2012 life.[5] Because the costs of regulations tend to be borne up front, though their benefits are not enjoyed until later, discounting tends to lower the expected net benefits of lifesaving regulation.[6] In practice, these results are even more distorted by the use of high discount rates. The commonly used discount rate of 7 percent[7] yields present valuations of roughly one-half the benefits expected ten years in the future, and just one quarter of the benefits expected in twenty years.[8]

To find the value of a life saved today—that is, before any discounting—agencies rely on economic calculations of the "value of a statistical life," commonly known as a VSL.[9] These calculations generally rely on assessments of observed willingness to pay (WTP) to avoid fatal risks and willingness to accept (WTA) such risks in exchange for money. For example, if dangerous jobs come with a wage premium, then the premium can be multiplied by the risk to find the worker's valuation of his own life. If a job with a one-in-one-thousand annual death risk pays $5000 more per year than a comparable job without the risk, the theory provides that the workers at the dangerous job exhibit a willingness to accept the risk in exchange for the premium.[10] The

benefit with a value of $x$ carries a present value of $x * (1/1.03^{10})$, or $0.744x$, if expected ten years from now. The discount rate takes into account the time-value of money, allowing someone to decide how valuable a dollar today is compared to a future dollar. With a discount rate of 5 percent, for example, the present value of a dollar promised to arrive in one year is 95.2 cents, and that same dollar scheduled to arrive in two years is worth 90.7 cents today. The discount rate is determined in part by the expected rate of inflation and the expected return on investments.

5. The equation is $1/1.03^{20} = 0.554$.

6. For example, a power plant required to install scrubbers to reduce toxic emissions would pay for the equipment long before any health benefits would be observed in communities near its smokestacks.

7. Office of Mgmt. & Budget, Circular A-4, Regulatory Analysis 31, 34 (2003), *available at* http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf ("For regulatory analysis, you should provide estimates of net benefits using both 3 percent and 7 percent.").

8. The equations are: $1/(1.07^{10}) = 0.508$ and $1/(1.07^{20}) = 0.258$. Note that benefits accruing in ten or twenty years are by no means unusual. A regulation, for example, that prevents children from consuming lead dust will provide benefits for the entire lives of the children protected. *See* U.S. ENVTL. PROT. AGENCY, COSTS AND BENEFITS OF REDUCING LEAD IN GASOLINE: FINAL REGULATORY IMPACT ANALYSIS (1985) [hereinafter REDUCING LEAD].

9. *See, e.g.*, Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines, 76 Fed. Reg. 54163, 54174 (Aug. 31, 2011) (to be codified at C.F.R. pt. 75); Lewis A. Kornhauser, *The Value of Life*, 38 CLEV. ST. L. REV. 209 (1990); W. Kip Viscusi, *The Value of Risks to Life and Health*, 31 J. ECON. LITERATURE 1912 (1993).

10. The potential flaws of this process—such as the assumption that workers know the salaries of colleagues and of workers at rival firms or the precise dangerousness of various worksites—are too numerous to discuss here. For purposes of this Essay, it will suffice to report that VSL figures obtained in part on the basis of such willingness to pay and willingness to accept data are commonly used by federal agencies. *See, e.g.*, Cranes and Derricks in Construction, 75 Fed. Reg. 47906, 48095 (Aug. 9, 2010) (to be codified at 29 C.F.R. pt. 1926) (reporting that agency

resulting VSL equals one thousand multiplied by $5000, or $5 million.[11]

In July 2011, however, DOT officials issued a memorandum titled "Treatment of the Economic Value of a Statistical Life in Departmental Analysis."[12] In addition to setting forth the agency's VSL for subsequent regulatory impact analyses, the document states, "[W]e will now forecast higher future VSL in response to expected income growth."[13] The new forecast procedure was explained as follows:

> In the revised guidance published on February 5, 2008, we adopted an income elasticity of 0.55 for adjusting past VSL to current values, but we did not use it to estimate anticipated VSL resulting from expected growth in real income levels. Since higher incomes should be reflected in willingness to pay for reduced risk, logical consistency requires that this income adjustment be incorporated in estimates of future as well as past and present VSL.[14]

In other words, the DOT had previously used income growth data to update old VSL numbers, allowing the agency to use more accurate values without waiting for new studies. For example, if a 2000 study set the VSL at $5 million, a regulatory impact analysis prepared in 2005 might use a VSL of, say, $5.2 million.[15] Under the new regime, the DOT will apply this reasoning to future lives. Accordingly, if a 2012 regulatory impact analysis predicts that a proposed rule would save a life in 2017, then the value of the future life would be increased from today's VSL by an appropriate annual multiplier. The DOT memorandum announced a present VSL of $6.2 million, meaning a life saved five years in the future would be worth almost $6.5 million.[16] The adjusted figure would then be discounted to its present value at the usual discount rates. In the past, discounting was performed on future lives assigned today's value, without any upward adjustment, and that practice remains standard at most agencies.

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"estimated monetized benefits for avoiding fatalities (the value of a statistical life, or VSL) or injuries (a value based on willingness to pay)").

11. If a worker is willing to exchange $5000 for a 1/1000 chance of dying, the theory provides that the worker values 1/1000 of her life at $5000.
12. POLLY TROTTENBERG & ROBERT S. RIVKIN, U.S. DEP'T OF TRANSP., TREATMENT OF THE ECONOMIC VALUE OF A STATISTICAL LIFE IN DEPARTMENTAL ANALYSIS, (July 29, 2011), *available at* http://regs.dot.gov/docs/Value_of_Life_July_29_2011.pdf [hereinafter DOT MEMORANDUM].
13. *Id.* at 1.
14. *Id.* at 2.
15. The DOT Memorandum announces an "annual VSL growth factor" of 1.00877. *Id.* at 2 & n.3. Accordingly, a statistical life worth $5 million today would be worth $5 million * $1.00877^5$, or about $5.22 million, in five years.
16. The equation is $6.2 million * $(1.00877^5)$ = $6.477 million.

As noted in the DOT Memorandum, the EPA has recently adopted a similar procedure.[17] In guidance issued to EPA staff concerning economic analysis, including cost–benefit analysis of proposed environmental regulation, the EPA stated, "The review supports . . . adjusting WTP estimates to account for higher future income levels."[18] Because of the EPA's broad responsibilities, the guidance applies to regulations issued pursuant to the Clean Water Act, the Clean Air Act, the Resource Conservation and Recovery Act, the Toxic Substances Control Act, and more than twenty additional statutes.[19]

The EPA has put its guidance into practice, incorporating VSL inflation[20] in the cost–benefit analysis supporting the issuance of major regulations. In September 2011, the EPA promulgated the "first-ever program to reduce greenhouse gas (GHG) emissions and improve fuel efficiency of heavy-duty trucks and buses."[21] Covering most trucks, buses, and vans, the standards are "designed to address the urgent and closely intertwined challenges of dependence on oil, energy security, and global climate change."[22] In the final regulatory impact analysis supporting the regulation, the EPA stated that it had inflated the values of future lives to account for rising incomes.[23] The agency

17. DOT MEMORANDUM, *supra* note 12, at 2 n.2; *see* U.S. ENVTL. PROT. AGENCY, GUIDELINES FOR PREPARING ECONOMIC ANALYSES, at App. B, 4–5 (2010) [hereinafter EPA GUIDELINES], *available at* http://yosemite.epa.gov/ee/epa/eed.nsf/pages/Guidelines.html ("[B]enefits estimates of reduced mortality risk accruing in future years may be adjusted to reflect anticipated income growth."); *see also* U.S. ENVTL. PROT. AGENCY, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT, 1990–2010, H-39 (1999), *available at* http://www.epa.gov/oar/sect812/1990-2010/chap1130.pdf (discussing the relationship between increased income and rising willingness to pay to avoid risks).

18. EPA GUIDELINES, *supra* note 17, at B-4.

19. For a list of statutes that the EPA is charged with administering, see *Summaries of Environmental Laws and EOs*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/lawsregs/laws/index.html (last updated Jan. 27, 2012).

20. The term "VSL inflation" was coined in Ben Trachtenberg, *Health Inflation, Wealth Inflation, and the Discounting of Human Life*, 89 OR. L. REV. 1313, 1341 (2011). The article, submitted to journals before the issuance of the EPA Guidelines and published a few months before the DOT Memorandum, noted that cost–benefit analysis (CBA) "calculators do not account for the growth of GDP in excess of inflation and population growth" and called for agencies to include "VSL inflation into their CBA calculation process" to avoid "pervasive undercounting of benefits." *Id.* at 1334, 1349, 1355.

21. *See* U.S. ENVTL. PROT. AGENCY, EPA AND NHTSA ADOPT FIRST-EVER PROGRAM TO REDUCE GREENHOUSE GAS EMISSIONS AND IMPROVE FUEL EFFICIENCY OF MEDIUM- AND HEAVY-DUTY ENGINES AND VEHICLES 1 (2011) [hereinafter EPA FACT SHEET], *available at* http://epa.gov/otaq/climate/documents/420f11031.pdf; *see also* Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 76 Fed. Reg. 57,106 (Sept. 15, 2011).

22. EPA FACT SHEET, *supra* note 21, at 1.

23. *See* U.S. ENVTL. PROT. AGENCY, FINAL RULEMAKING TO ESTABLISH GREENHOUSE GAS EMISSIONS STANDARDS AND FUEL EFFICIENCY STANDARDS FOR MEDIUM- AND HEAVY-DUTY ENGINES AND VEHICLES, REGULATORY IMPACT ANALYSIS 8–96 (2011), *available at*

used the same procedure in drafting an August 2011 rule on ozone and fine particulate emissions.[24] Using an old VSL of $6.3 million, the EPA "account[ed] for income growth to 2014" and found that, after "applying these adjustments to the $6.3 million value [in 2000 dollars], the [resulting future] VSL is $8.7 million [in 2007 dollars]."[25]

The two agencies adopting VSL inflation procedures are especially important actors in the valuation of human life for purposes of federal regulation. The EPA's responsibilities require it to protect public health in a variety of contexts, and we can expect to see similar calculations in EPA regulatory impact analyses concerning wastewater management,[26] toxic substances,[27] and solid waste.[28] The DOT supervises several agencies whose missions include issuing regulations to protect Americans from fatal risk. For example, the DOT is composed of the Federal Aviation Administration, the National Highway Traffic Safety Administration, the Federal Railroad Administration, and others.[29] In addition, because these agencies have so much expertise in cost–benefit analysis, their procedures and results are often adopted by other regulators.[30]

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http://epa.gov/otaq/climate/documents/420r11901.pdf. According to the regulatory impact analysis, "All values are in constant year 2007 dollars, adjusted for growth in real income out to 2030 using projections provided by Standard and Poor's. Economic theory argues that [willingness to pay] for most goods (such as environmental protection) will increase if real income increases." *Id.*

24. *See* Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208, 48,314 (Aug. 8, 2011) (to be codified at 40 C.F.R. pt. 51).
25. *Id.* at 48,314 n.97.
26. Pursuant to the Clean Water Act, the EPA runs the National Pollutant Discharge Elimination System permit program. *See* Clean Water Act § 402, 33 U.S.C. § 1342.
27. The EPA's regulations under the Toxic Substances Control Act spawned one of the most famous cases of judicial review of agency cost–benefit analysis. *See* Corrosion Proof Fittings v. EPA, 947 F.2d 1201 (5th Cir. 1991) (striking down an asbestos regulation).
28. For a squabble over the interstices of an EPA solid waste regulation, see *American Petroleum Institute v. EPA*, 216 F.3d 50 (D.C. Cir. 2000) (considering "sham recycling" under the Resource Conservation and Recovery Act).
29. For regulations issued by these agencies whose benefits are measured in saved human lives, see, for example, Flightcrew Member Duty and Rest Requirements, 77 Fed. Reg. 330 (Jan. 4, 2012) (to be codified at 14 C.F.R. pt. 117); Restrictions on Railroad Operating Employees' Use of Cellular Telephones and Other Electronic Devices, 75 Fed. Reg. 27,672, 27,673 (May 18, 2010) (to be codified at 49 C.F.R. pt. 220); Federal Motor Vehicle Safety Standards; Child Restraint Systems; Child Restraint Anchorage Systems, 64 Fed. Reg. 10,786 (Mar. 5, 1999) (to be codified at 49 C.F.R. pt. 571).
30. *See, e.g.*, Labeling for Bronchodilators to Treat Asthma; Cold, Cough, Allergy, Bronchodilator, and Antiasthmatic Drug Products for Over-the-Counter Human Use, 76 Fed. Reg. 44,475, 44,482 (July 26, 2011) (to be codified at 21 C.F.R. pt. 201) (Health & Human Services final rule stating, "Estimated statistical lives saved are valued using Environmental Protection Agency (EPA)'s value of a statistical life (VSL)").

Other regulatory agencies charged with protecting human life should strongly consider implementing their own VSL inflation rules. As noted in the DOT memorandum, if agencies inflate VSLs from old studies to determine useful numbers for current analysis, "logical consistency requires that this income adjustment be incorporated in estimates of future as well as past and present VSL."[31] More importantly, VSL inflation helps to counteract the unreasonably high discount rates applied by federal agencies to future benefits. Because the benefits of regulations tend to arrive well after their costs are incurred, a high discount rate creates the appearance that otherwise sensible regulations are not worth their price.[32] This problem is especially acute when confronting global climate change, the amelioration of which will yield benefits decades into the future.

Cost–benefit analysis is a mandatory part of the regulatory process and has been required by every president since Ronald Reagan.[33] Federal law charges agencies to "maximize net benefits,"[34] and a pervasive undercounting of benefits makes compliance impossible. Beyond legal compliance, undervaluation of benefits has real-world consequences. If agencies undervalue the benefits they are required to secure, then the public will receive fewer benefits.[35] When the benefits at issue are protection from fatal risks—for example, respiratory illnesses caused by pollution, or deadly car crashes—the public pays the ultimate price. Undervaluing life leads to death.

The new DOT and EPA procedures that incorporate inflation into future VSLs will likely save lives. On the other hand, any procedure that tends to increase the predicted net benefits of regulation invites attack from regulated entities opposed to increased regulatory burdens.[36] Every notice and comment proceeding presents an opportunity for renewed objection to regulatory impact analyses incorporating wealth inflation. A new presidential administration could issue new memoranda and guidance instructing agencies to calculate benefits without VSL inflation. This is a battle worth watching.

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31. DOT MEMORANDUM, *supra* note 12, at 2.
32. *See* Tyler Cowen & Derek Parfit, *Against the Social Discount Rate*, *in* JUSTICE BETWEEN AGE GROUPS AND GENERATIONS 144, 145 (Peter Laslett & James S. Fishkin eds., 1992); *see also* REDUCING LEAD, *supra* note 8, at I-23 ("Generally, the higher the discount rate, the lower the net benefits, because costs usually are incurred sooner than benefits.").
33. *See* Exec. Order No. 12,866, 3 C.F.R. 638 (1994), *reprinted as amended in* 5 U.S.C. § 601 (2006).
34. *Id.* § 1.
35. *See generally* Cowen & Parfit, *supra* note 32, at 144–45, 159.
36. *See, e.g.*, Rena Steinzor & Michael Patoka, *The Bottleneck*, 29 ENVTL. FORUM 36 (Jan.–Feb. 2012), *available at* http://www.thecre.com/pdf/20120102_regweeksteinzor.pdf (critiquing the influence of regulated entities and their lobbyists on decisions by the White House Office of Information and Regulatory Affairs).