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# In Praise of Numbers: A Reply

CASS R. SUNSTEIN\*

The legal culture contains countless discussions of the vices and virtues of cost-benefit analysis.<sup>1</sup> But it has hardly any explorations of the real world of cost-benefit analysis—of what agencies do, concretely, when they do cost-benefit analysis. We know very little about the interactions among law, science, and economics in the actual, rather than theoretical, world of cost-benefit balancing.

*The Arithmetic of Arsenic*<sup>2</sup> represents a modest effort to begin to fill this gap. My goal was to explore not whether cost-benefit is a good idea in the abstract, but what it means in practice. In fact my major purposes were descriptive and conceptual, not normative. I wanted to highlight a topic about which lawyers and judges know too little: the specific questions whose answers can drive “benefits numbers” in one or another direction. For low levels of arsenic, we lack clear knowledge of the likely health benefits, and any extrapolation from the data will depend on some disputable judgments, involving above all: (1) the dose-response curve, (2) the use of data from other nations, and (3) the decision whether to quantify certain risks on the basis of highly speculative evidence.<sup>3</sup> Monetization of benefits raises further problems involving the valuation of both life and health and the appropriate discount rate for cancers to be averted in the future. With an understanding of these problems, we can see exactly why there are reasonable disputes about both nonmonetized and monetized benefits—why some estimates are high and others are lower. We can also isolate the issues on which more progress, both conceptual and empirical, might be made in the future.

In identifying those issues, I did not seek to resolve them, much less say how the arsenic controversy should be handled (though in a few places I offered some tentative judgments). I meant instead to provide a kind of lawyer’s primer on the real world of cost-benefit analysis, in the process showing where legal objections might be raised, explaining why a deferential judicial role might make sense, and indicating why a “benefits range,” and a wide one at that, is sometimes the most that can be offered.

I am extremely grateful to Lisa Heinzerling and Thomas McGarity for their valuable comments and criticisms. Their objections seem to me to fall into two

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1. For a valuable collection, see *COST-BENEFIT ANALYSIS: LEGAL, ECONOMIC, AND PHILOSOPHICAL PERSPECTIVES* (Matthew D. Adler & Eric A. Posner eds., 2001).

2. Cass R. Sunstein, *The Arithmetic of Arsenic*, 90 GEO. L.J. 2255 (2002).

3. McGarity’s title is therefore fitting, though the fuzziness seems to me inescapable in light of gaps in knowledge. Thomas O. McGarity, *Professor Sunstein’s Fuzzy Math*, 90 GEO. L.J. 2341 (2002).

categories—the first involving the assessment of benefits (my major theme, and a topic emphasized by Heinzerling), the second involving the assessment of cost-benefit analysis itself (which both of them dislike). In this brief reply, I take up these two kinds of criticisms in sequence.

### I. ASSESSING BENEFITS

Much of Heinzerling's response urges that the EPA should have placed a higher monetary value on life. She emphasizes, for example, that the value-of-life data is quite old (from the 1970s). In her view, per capita growth in economic activity requires a significant upward adjustment.<sup>4</sup> She also contends that the EPA should have used a cancer premium on the ground that cancer risks receive a higher willingness to pay than other deaths.<sup>5</sup> These are entirely plausible claims and well worth further investigation.

But some of Heinzerling's other suggestions seem to me more doubtful. She contends, for example, that because cancer is involved, the EPA was wrong to have concluded that the benefits of the arsenic rule should be discounted because cancer arises decades after exposure to its cause.<sup>6</sup> To be sure, it is hard to know how the discounting problem should be handled. But isn't it much worse to get cancer tomorrow than to get cancer twenty years from tomorrow? Isn't it much worse to die in a plane crash tomorrow than to die from cancer twenty years from tomorrow? Heinzerling is right to emphasize the existence of a cancer premium. But even with that premium, it seems reasonable to discount risks that will not turn into harms for many decades.<sup>7</sup>

I also wonder about Heinzerling's suggestion that the EPA should have

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4. Lisa Heinzerling, *Markets for Arsenic*, 90 GEO. L.J. 2311, 2320 (2002). With respect to wealth adjustments, I agree with Heinzerling that poor people's lives should not be valued less than the lives of wealthy people. The complexity here is that poor people are willing, because of their poverty, to spend less to reduce a statistical risk than wealthy people and that it is not clear that government does poor people any favor by forcing them to spend more than they are willing to pay. (This assumes that people are adequately informed and that individuals are being required to pay for risk reduction, which is true in the case of arsenic but not, fortunately, in every case.)

5. *Id.* at 2317–18.

6. The Scientific Advisory Board raises another issue, not discussed by the EPA: the "cessation lag," meaning the lag between a reduction in exposure and a reduction in risk. *See* ARSENIC RULE BENEFITS REVIEW PANEL, U.S. ENVTL. PROT. AGENCY, ARSENIC RULE BENEFITS ANALYSIS: AN SAB REVIEW 6–7 (2001), available at <http://www.epa.gov.sab/ec01008.pdf>. Imagine that those now being exposed to 45 parts-per-billion (ppb) of arsenic are exposed in 2006 to 10 ppb. If so, it will take a while until cancer risks will be equivalent to what they would be if everyone, all of the time, was exposed to 10 ppb or less. Because the EPA did not take account of the cessation lag, the Science Advisory Board suggests that it presented an upper bound on mortality and morbidity savings. *Id.* at 5.

7. I am not sure that I understand Heinzerling's objection to the idea that risks that are run involuntarily should be valued especially highly. *See* Heinzerling, *supra* note 4 at 2327. To be sure, the line between voluntarily and involuntarily run risks is one of degree, not of kind. *See* Cass R. Sunstein, *The Laws of Fear*, 115 HARV. L. REV. 1119, 1154–55 (2002) (book review). When we say that a risk is involuntarily run, we typically mean that those who run it are unaware of it, or that it is very costly for people to avoid it. *See id.* at 1154. But when the costs of risk-avoidance are especially high, it makes sense to devote extra resources to reducing it. Of course Heinzerling is right to say that there is no market for risks that are involuntarily run in the strong sense.

assessed the benefits of reducing arsenic in drinking water by examining the market for bottled water.<sup>8</sup> As Heinzerling notes, many people buy bottled water for the taste, not for the increase in safety. In any case, most people do not buy bottled water. It would be extremely odd for government to use the Safe Drinking Water Act to do the equivalent of forcing people to buy bottled water when this option is rejected by most people. (Should the National Highway Safety Traffic Administration require all car manufacturers to spend the amount spent on safety by Volvo owners?)

Heinzerling also suggests that instead of using a number for statistical lives, the EPA might have done better to survey consumers, asking them how much they would be willing to pay to reduce arsenic levels in drinking water.<sup>9</sup> She thinks that such a survey would reveal that people would be willing to pay more than enough for significant reductions. As it happens, I conducted just such a survey with University of Chicago law students. The survey produced a median willingness to pay \$100 to eliminate a 1/100,000 risk and a median willingness to pay \$50 to eliminate a 1/1,000,000 risk.<sup>10</sup> These numbers, among a fairly affluent group, do not suggest that the EPA's choice was as easy as Heinzerling indicates, because the mean cost per household, for the 10 ppb standard, ranged from under \$1 to over \$300.<sup>11</sup> Of course there are serious doubts about the meaningfulness of people's answers to survey questions of this kind, especially when low probabilities are involved.<sup>12</sup> Hence it was reasonable, it seems to me, for the EPA (assuming that it was interested in willingness to pay) to use its standard dollar amount per life saved, rather than to rely on surveys.

McGarity emphasizes the EPA's legitimate difficulties in handling adverse effects that it considered nonquantifiable, including certain cancers, hypertension, diabetes, and reproductive effects. He is concerned that these effects "fade in and out of" my analysis "like an aircraft warning beacon"—and also that

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8. Heinzerling, *supra* note 4, at 2324–27.

9. *Id.* at 2325.

10. For a full discussion, see Cass R. Sunstein, *Probability Neglect: Emotions, Worst Cases, and the Law*, 112 *YALE L.J.* 61 (2002).

11. Note that this was true at the time that the EPA made its initial decision; subsequent data and analysis have strengthened the case for reduction below 20 ppb. See SUMCOMM. ON ARSENIC IN DRINKING WATER, NAT'L RESEARCH COUNCIL, ARSENIC IN DRINKING WATER: 2001 UPDATE (2001).

Heinzerling engages in some clever framing to make the issue seem easy. She compares a 20 ppb standard to the more protective alternatives—an illuminating exercise to be sure, but one that does not adequately describe the EPA's choice, which was whether and how to depart from the 50 ppb standard. She also calculates the amount that consumers would be willing to spend per day, finding the very low number conclusive on the question. But this kind of framing proves too much. See Sunstein, *supra* note 2, at 2295. There are countless worthy causes that might reasonably ask Americans to spend, say, a dollar a day. Assuming that 250 million Americans participate, each dollar-a-day program could raise \$91.5 billion. Is it worth spending \$91.5 billion to clean up hazardous waste dumps? To reduce benzene emissions? To reduce greenhouse gases? To immunize children? To improve education in poor neighborhoods? To house people who need housing? To improve national defense? To increase the number of police officers on the streets? To do all of these eight dollar-a-day programs, raising over \$720 billion? To do more?

12. See Sunstein, *supra* note 10.

once all of them are included, my low-end estimates “are too low” and my high-end estimates “may only be slightly too high or perhaps not high enough.”<sup>13</sup> All of these points are reasonable. My basic suggestion is that benefits should be quantified if this is at all possible.<sup>14</sup> In general, the EPA should assign numbers to adverse effects whenever it can, if only to provide a range, and it should have done more in this vein here. In this case, as in many others, efforts at quantification illuminate the analysis, even when there is uncertainty.<sup>15</sup>

Heinzerling dislikes the willingness-to-pay criterion. Her most interesting claim is that market behavior is likely to be inadequately informed, not least because people are “intuitive toxicologists,” acting in the market domain as they do in politics.<sup>16</sup> For this reason she doubts that market evidence reveals people’s informed tradeoffs between dollars and statistical risks. Heinzerling is right to say that cognitive problems and simple ignorance play a role in the market domain; her Perrier example might well be a case in point. The real question, an empirical one, is whether some correctives might not be provided by the sheer number of people involved in market decisions. Many of us do not know whether products we buy will do what they are supposed to do; yet the knowledge of some is enough to ensure, most of the time at least, that there is a correlation between quality and cost. In the domain of risks, it is possible that market processes will work in the same way, ensuring, much of the time, that risky products will cost more than less risky ones, and that other things being equal, employers will have to pay people a wage premium for higher risks. The evidence here is suggestive if not conclusive, indicating that in markets, at least, people will not pay infinite or even huge amounts to eliminate low-level cancer risks. Indeed the amounts they are willing to pay fall within a certain range, one that is wide but far from unbounded.<sup>17</sup> Of course, Heinzerling is right to question whether an examination of market behavior can uncover informed judgments about the price of a statistical life.

## II. ASSESSING COST-BENEFIT ANALYSIS

To say the least, Heinzerling and McGarity are skeptics about cost-benefit analysis. I do not share their skepticism. In my view, cost-benefit analysis should be seen as a valuable tool, partly as a way to counteract the errors that we all make in thinking about risk, partly as a mechanism for ensuring that government addresses serious problems rather than trivial ones, partly as a way

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13. McGarity, *supra* note 3, at 2351–52.

14. The point is emphasized by the Science Advisory Board, asking for more quantification from the EPA. See ARSENIC RULE BENEFITS REVIEW PANEL, *supra* note 6, at 3.

15. McGarity also objects to my very tentative suggestion that if we include an appropriate discount rate, \$4.5 million is a sensible value for statistical lives in this context. McGarity, *supra* note 3, at 2355–56. While discounting seems to me sensible here, I am not at all wedded to the \$4.5 million number and would welcome alternative suggestions.

16. Heinzerling, *supra* note 4, at 2330.

17. See W. KIP VISCUSI, FATAL TRADEOFFS: PUBLIC & PRIVATE RESPONSIBILITIES FOR RISK (1992).

of getting a sense of the consequences in front of decisionmakers before they act.<sup>18</sup> Is this so terribly controversial? Is it not revealing that President Clinton, no less than Presidents Reagan and Bush, required agencies to produce cost-benefit analyses of major rules?<sup>19</sup>

To be sure, cost-benefit analysis may be unhelpful or misused in practice, simply because of the indeterminacy in the data. A lurking question, pressed by both Heinzerling and McGarity, is whether the arsenic controversy supports or undermines the argument for cost-benefit analysis.<sup>20</sup> I think that the analysis was helpful, simply because it showed the range of potential effects from low levels of arsenic exposure. The analysis greatly weakened the efforts of interest groups and others to treat the old 50 ppb standard as unexceptionable. After the EPA did its work, no one could responsibly contend that it would be silly to rethink the old standard. Indeed, the analysis—especially taken in light of the 2001 report from the National Research Council<sup>21</sup>—helped show that the 10 ppb standard would not be exceedingly costly and likely would be a real improvement, in terms of public health, over the 50 ppb standard. At the same time, the analysis showed why reasonable people might be uncertain whether there would be very large public health gains from a standard below (say) 20 ppb. (Note in this regard that Canada, a nation not unconcerned with the health of its citizens, has a standard of 25 ppb.<sup>22</sup>)

Heinzerling's attack on cost-benefit analysis seems to be based not on a belief that costs and benefits are irrelevant, but on the willingness-to-pay criterion, which she identifies with cost-benefit analysis. The identification is understandable: Those who do cost-benefit analysis generally use that criterion. But to engage in cost-benefit analysis, we can value benefits however we like. In the 1960s and 1970s, it was popular to use the "human capital" approach, which values life by looking at lost earnings.<sup>23</sup> This method, still popular within the courts, produced amounts that were a mere fraction of those elicited by willingness-to-pay methods. Or suppose that a contemporary analyst rejected willingness to pay and instead chose, for her own reasons, \$15 million as the presumptive amount to spend per statistical life—with the presumptive amount subject to increase or decrease if the circumstances warranted either.<sup>24</sup> Such an analyst could still compare costs and benefits. We might even start with the amounts that emerge from labor market studies, not because we have a deep

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18. See Matthew D. Adler & Eric A. Posner, *Rethinking Cost-Benefit Analysis*, 109 YALE L.J. 165, 179 (1999); CASS R. SUNSTEIN, *RISK AND REASON* (forthcoming 2002).

19. Exec. Order No. 12,866, 58 Fed. Reg. 51,735 (Sept. 30, 1993).

20. Heinzerling, *supra* note 4, at 2313; McGarity, *supra* note 3, at 2364–65.

21. See SUMCOMM. ON ARSENIC IN DRINKING WATER, *supra* note 11.

22. ROBERT PERCIVAL ET AL., *ENVIRONMENTAL REGULATION* 122 (3d ed. 2000).

23. See VISCUSI, *supra* note 17, at 17–18.

24. An increase may occur if, for example, children were mostly at risk, or a decrease if elderly people were mostly at risk. Of course the life-years criterion could automatically incorporate this variable. Note that the Science Advisory Board sensibly asked the EPA to consider the "age distribution of cases avoided whenever possible." See ARSENIC RULE BENEFITS REVIEW PANEL, *supra* note 6, at 5.

commitment to willingness to pay, but because of a democratic judgment that those amounts provide a reasonable place to begin. What seems to me most important is not to be dogmatic about willingness to pay, but to ensure against uninformed stabs in the dark and to promote coherence and sense in regulation—so that we are not spending small sums on large problems and large sums on small problems.

McGarity thinks that the largest lesson of the arsenic controversy involves the “daunting scientific uncertainties” that plague cost-benefit analysis.<sup>25</sup> In view of these uncertainties, he thinks that cost-benefit analysis is a matter of “frequently preposterous and always manipulable number spinning.”<sup>26</sup> He has a point. But it need not be a matter of “spinning.” We might try instead to identify the likely range of effects, and when the range is large, we might want to know why the benefits might be small and why they might be big.<sup>27</sup> If we are choosing among several levels of protection, what should we do instead? Guess? Flip a coin? Does it really make sense to conclude (as both Heinzerling and McGarity seem to do) that whenever people are being exposed to a carcinogen (any carcinogen?), the government should regulate to the point that is “feasible” for industry<sup>28</sup>—even if the cost is (say) \$900 billion and the health benefits are likely to be trivial?<sup>29</sup>

I suspect that both Heinzerling and McGarity think that cost-benefit analysis fails cost-benefit analysis. They believe that all things considered, we would be better off with some other standard—for example, basing standards on feasibility. They might be right! If cost-benefit analysis simply makes it harder for agencies to protect the public, and mostly increases the power of regulated groups to block desirable regulation, it is hard to celebrate cost-benefit analysis. But there are reasons to believe that cost-benefit analysis is not simply an antiregulatory tool. Indeed cost-benefit analysis helped spur the removal of lead from gasoline and dramatic steps, pushed by the United States, to eliminate

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25. McGarity, *supra* note 3, at 2344.

26. *Id.* at 2366.

27. One possibility is to create a margin of safety, an idea supported by McGarity and often found in federal law. *See, e.g.*, Clean Air Act § 108, 42 U.S.C. § 7408 (2000). Often a margin of safety makes sense to prevent risks that are possible but not demonstrable. But sometimes there are risks and costs on all sides of the equation, and when a margin of safety itself creates risks and costs, a high margin of safety can be a bad idea. *See* INDUR M. GOKLANY, *THE PRECAUTIONARY PRINCIPLE: A CRITICAL APPRAISAL OF RISK ASSESSMENT* (2001).

28. McGarity approves of the technology-based approach on the ground that it “says that we ought to do ‘the best we can’ to protect human health from environmental contaminants, especially those that result from profit-making human activities.” McGarity, *supra* note 3, at 2374. The difficulty arises if the costs imposed on “profit-making human activities” turn out to be significant human costs, in the form of lower wages, decreased employment, higher prices, or even poverty. If the costs merely mean reduced profits, there is much less to worry about.

29. Heinzerling and McGarity are correct to say that costs play some rule under statutory provisions that are based on an inquiry into technology. *See, e.g.*, 33 U.S.C. § 1314(b)(2)(B) (2000). The problem is that benefits are not assessed and that there is no direct balancing of costs and benefits.

chlorofluorocarbons, which contribute to depletion of the ozone layer.<sup>30</sup> More recently, the Office of Information and Regulatory Affairs (OIRA) has pioneered the idea of a “prompt letter”—letters designed to promote agencies to act in cases in which the benefits of action seem to outweigh the costs.<sup>31</sup> Inspired by tentative cost-benefit analysis, OIRA has asked the Occupational Safety and Health Administration to consider requiring the placement of automatic defibrillators in workplaces, has urged the Food and Drug Administration to issue a final rule requiring disclosure of the level of trans fatty acids in foods, and has asked the Department of Transportation to take steps to improve automobile safety by establishing a high-speed, frontal offset crash test. In any case, cost-benefit analysis has often driven policy in more sensible directions, by showing the best means of achieving regulatory goals.<sup>32</sup>

It remains important to ask whether cost-benefit analysis can be defended on normative grounds. But for better or for worse, cost-benefit analysis is here to stay. We need to be asking a number of more concrete questions. Where does science leave gaps, and what gaps does it leave? What are the sources of high benefit judgments and low benefit judgments? How does the dose-response curve matter? How should we think about harms that will not occur for decades? Are there systematic distortions on the cost side, and if so why? An investigation of the arsenic controversy casts light on these questions. But there is a lot more to do.

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30. See *ECONOMIC ANALYSES AT EPA: ASSESSING REGULATORY IMPACT* (Richard D. Morgenstern ed., 1997).

31. See [http://www.whitehouse.gov/omb/inforeg/prompt\\_letter.html](http://www.whitehouse.gov/omb/inforeg/prompt_letter.html).

32. See *ECONOMIC ANALYSES AT EPA*, *supra* note 30.

