

ISSN 1936-5349 (print)  
ISSN 1936-5357 (online)

# HARVARD

JOHN M. OLIN CENTER FOR LAW, ECONOMICS, AND BUSINESS

## THE LIMITS OF QUANTIFICATION

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Forthcoming in *California Law Review*

Discussion Paper No. 784

07/2014

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## The Limits of Quantification

Cass R. Sunstein\*

### Abstract

*The problem of nonquantifiability is a recurrent one in both public policy and ordinary life. Much of the time, we cannot quantify the benefits of potential courses of action, or the costs, or both, and we must nonetheless decide whether and how to proceed. Under existing Executive Orders, agencies are generally required to quantify both benefits and costs, and (to the extent permitted by law) to show that the former justify the latter. But agencies are also permitted to consider apparently nonquantifiable factors, such as human dignity and fairness, and also to consider factors that are not quantifiable because of the limits of existing knowledge. When quantification is impossible, agencies should engage in “breakeven analysis,” by which they explore how high the nonquantifiable benefits would have to be in order for the benefits to justify the costs. Breakeven analysis can be used and potentially disciplined in three different ways. (1) Sometimes agencies are able to identify lower or upper bounds, either through point estimates or through an assessment of expected value. (2) Agencies can often make progress by exploring comparison cases in which relevant values have already been assigned (such as for a statistical life). (3) When agencies cannot identify lower or upper bounds, and when helpful comparisons are unavailable, breakeven analysis requires agencies to identify what information is missing and to specify the conditions under which benefits would justify costs (“conditional justification”). In admittedly rare cases, regulators, no less than individuals, might have to “pick” or instead to “opt.”*

### I. The Problem and The Plan

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\* Robert Walmsley University Professor, Harvard University. This Article grows out of the Brennan Lecture, delivered at the University of California, Berkeley in 2013 and New York University in 2014. The author is especially grateful to superb commentators for valuable suggestions and objections – at the University of California, Daniel Farber, Lisa Heinzerling, and Richard Revesz, and at New York University, Oren Bar-Gill, Richard Revesz, and Jeremy Waldron. The author is also grateful to Michael Greenstone, Eric Posner, Adrian Vermeule, and Richard Zeckhauser for excellent comments on a previous draft. The author is grateful as well to Cassie Chambers for superb research assistance. From 2009 to 2012, the author was Administrator of the White House Office of Information and Regulatory Affairs, where the issues discussed in this Essay frequently arose. This Article draws on an earlier essay, which appears as *Nonquantifiable*, a chapter in Cass R. Sunstein, *Valuing Life* (forthcoming 2014), and available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2259279](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2259279).

In the world of regulation, as in ordinary life, nonquantifiable values often play a significant role. Sometimes federal agencies are not able to quantify either the benefits or the costs of regulations. If so, how should they proceed?

Here is an illustration. In 2014, the Department of Transportation finalized a rule that will require rear visibility cameras to be installed in all vehicles sold after 2018.<sup>1</sup> The rule is designed to promote safety by enabling drivers to see an adequate area in back of vehicles. The Department of Transportation projects that the regulation will cost between \$546 million and \$620 million -- and perhaps as much as \$924 million.<sup>2</sup> At the same time, the Department projects quantifiable benefits of only \$265 million to \$396 million, with a high-end estimate of \$595 million.<sup>3</sup> On most reasonable assumptions, the rule would have monetized benefits that are at least \$200 million lower than the monetized costs.

To explain its decision to proceed, the Department referred to an assortment of nonquantifiable values.<sup>4</sup> Very young children are at risk, suggesting that the standard \$9 million the “value of a statistical life” might be too low. In some of these cases, parents might be killing their own children, suggesting that the standard value is missing something important (and searing), which is the parents’ life-long anguish. Disabled people and old people are also at risk, raising a point about fairness and equity, because they have unusual difficulty in protecting themselves. Finally, increased rear visibility will make it easier to drive and particularly to park, an improvement that the Department could not quantify.

This is merely one example; we will encounter many others. In the domain of financial regulation, nonquantifiability is a recurring problem, because both the benefits and the costs of some regulatory requirements are exceptionally difficult to specify, not least when they are designed to reduce the risk of another financial meltdown.<sup>5</sup> That difficulty has put a great deal of pressure on the financial regulators, because courts seem to be requiring a high degree of quantification.<sup>6</sup> Apart from legal requirements, the regulators face a serious question: How should they decide whether and how to proceed, if any effort to specify costs and benefits is speculative, perhaps preposterously so?

In this Article, I shall argue that to the extent feasible, agencies should adopt a highly structured approach, aspiring to maximize quantification and transparency. That approach quantifies what can be quantified, acknowledges what cannot, and adopts a specific framework to help regulators to decide how to proceed in the way of limited information. As we shall see, the framework is rooted in the idea of *breakeven analysis*,

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<sup>1</sup> <https://www.federalregister.gov/articles/2014/04/07/2014-07469/federal-motor-vehicle-safety-standards-rear-visibility>

<sup>2</sup> Id.

<sup>3</sup> Id.

<sup>4</sup> Id.

<sup>5</sup> See John Coates, Cost-Benefit Analysis of Financial Regulation, Yale LJ (forthcoming 2015), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2375396](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2375396).

<sup>6</sup> See id.; *Business Roundtable v. SEC*, 647 F.3d 1144 (DC Cir 2013).

which asks agencies to answer this question: How high would the benefits have to be, for the regulation to be justified?

The motivation for this approach is straightforward. Regulatory decisions have important human consequences, both good and bad, and regulators should do the best they can to proceed on the basis of an understanding of those consequences. Cost-benefit analysis remains the best available method for capturing the human consequences,<sup>7</sup> even though it has serious limitations, some of which I shall explore here. Breakeven analysis, as I shall develop it, is a way to engage in a form of cost-benefit analysis when regulators face serious limitations in knowledge.

Social welfare is of course the master concept, and it can be specified in different ways; distributional effects certainly deserve careful attention and may well matter to regulatory decisions.<sup>8</sup> When agencies engage in breakeven analysis, they might well take account of distributional effects, or indeed of any other factors that are properly part of the welfare analysis. The approach and framework outlined here are meant to help to increase the likelihood that even when quantification is not possible, regulators make the best possible decisions in welfarist terms.<sup>9</sup>

My focus throughout is on regulatory policy, but it should be clear that the implications are far broader. In many areas of law and policy, it is important and perhaps even necessary to catalogue both costs and benefits and to explore whether the benefits justify the costs. In tort law, of course, judgments of negligence may depend on some such inquiry,<sup>10</sup> and nonquantifiable values might be involved. Damage questions often run into concerns about quantifiability; consider the question of pain and suffering.<sup>11</sup> Budgetary decisions may also depend on an accounting of costs and benefits.<sup>12</sup> In numerous domains, that accounting matters, and nonquantifiable variables turn out to be relevant. What is said here is relevant to those domains as well. It is even relevant for ordinary life, where values are often nonquantifiable, and at least some kind of implicit breakeven analysis turns out to be at work.

The remainder of this Article is structured as follows. Part II investigates three different meanings of the idea of nonquantifiability, and specifies the nature of the epistemic problem that regulators sometimes face. Part III explores the relationship between nonquantifiability and breakeven analysis and offers an introductory framework. Part IV sketches an illustrative set of cases in which breakeven analysis might be applied.

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<sup>7</sup> See Matthew Adler and Eric A. Posner, *Foundations of Cost-Benefit Analysis*; for a somewhat different view, see Matthew Adler, *Well-Being and Fair Distribution* (2011).

<sup>8</sup> *Id.*

<sup>9</sup> For provocative argument that agencies should rely on welfare measures rather than cost-benefit analysis, see John Bronsteen et al., *Well-Being Analysis vs. Cost-Benefit Analysis*, 62 *Duke LJ* 1603 (2013). The authors convincingly argue that welfare is the master concept; the question remains whether apparently direct measures of welfare, as for example though surveys, are ready for official use.

<sup>10</sup> See Richard A. Posner, *A Theory of Negligence*, 1 *J. Legal Stud.* 29 (1972).

<sup>11</sup> See Cass R. Sunstein, *Illusory Losses*, 37 *J Legal Stud* S157 (2008).

<sup>12</sup> See Jeffrey Zients, *Memorandum to the Heads of Executive Agencies and Departments*, available at <http://www.whitehouse.gov/sites/default/files/omb/memoranda/2012/m-12-14.pdf>

Part V, the heart of the Article, elaborates the framework in detail. Part VI briefly concludes.

## II. Nonquantifiability: A Guided Tour

### A. Three Challenges for Quantifiers

1. *Puzzles.* The task of quantifying regulatory benefits raises many puzzles.<sup>13</sup> Agencies have long produced a monetary value for the loss of a life,<sup>14</sup> but skeptics have doubted both the sense and morality of such efforts.<sup>15</sup> In fact agencies do not “value life” or assign monetary values to a human life. Instead they are concerned with statistical mortality risks -- finding, for example, that people are willing to pay \$90, and no more, to eliminate a risk of 1 in 100,000.<sup>16</sup> If this is true as an empirical matter, then agencies might build on evidence about actual behavior to value risks of 1 in 100,000 at \$90 as well.<sup>17</sup> A practice of this sort has become pervasive.<sup>18</sup> People do, in fact, pay certain amounts to reduce statistical risks, and for that reason, monetization of such risks is not preposterous or difficult, at least in principle.

Those influenced by behavioral economics might note that willingness to pay need not equal willingness to accept.<sup>19</sup> Perhaps we should be asking how much people are willing to accept to face mortality risks. But at least in this context, the answers to such questions do not appear to be different from those that are given to willingness to pay questions.<sup>20</sup> Those influenced by behavioral economics might also wonder whether the resulting numbers might reflect some kind of information-processing problem or behavioral bias. If workers receive \$90 to incur a risk of 1 in 100,000, should we conclude that workers are actually demanding that amount of money, and no more, for that risk? Choices about where to work are extremely “noisy,” in the sense that multiple

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<sup>13</sup> For relevant discussion, see Matthew Adler and Eric Posner, *New Foundations of Cost-Benefit Analysis* (2006); Matthew Adler, *Well-Being and Fair Distribution: Beyond Cost-Benefit Analysis* (2011).

<sup>14</sup> See note supra for discussions and W. Kip Viscusi, *Fatal Tradeoffs* (1992) for the basic theory.

<sup>15</sup> See, e.g., Frank Ackerman and Lisa Heinzerling, *Priceless* (2004).

<sup>16</sup> See W. Kip Viscusi, *Rational Risk Policy* (1998).

<sup>17</sup> On some of the complexities here, see Cass R. Sunstein, *Valuing Life: A Plea for Disaggregation*, 54 *Duke LJ* 385 (2004).

<sup>18</sup> See, e.g., note supra.

<sup>19</sup> See Elizabeth Hoffman and Matthew Spitzer, *Willingness to Pay vs. Willingness to Accept: Legal and Economic Implications*, 71 *Wash. U. L. Q.* 59 (1993).

<sup>20</sup> See Thomas Kniesner et al., *Willingness to Accept Equals Willingness to Pay for Labor Market Estimates of the Value of Statistical Life* (2012), available at

[http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2221038](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2221038). There is also a question about whether bounded rationality of various sorts – for example, unrealistic optimism, see Tali Sharot, *The Optimism Bias* (2010) – might “impeach” the numbers that emerge from revealed preference studies.

<sup>20</sup> See Thomas Kniesner et al., *Willingness to Accept Equals Willingness to Pay for Labor Market Estimates of the Value of Statistical Life* (2012), available at

[http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2221038](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2221038). There is also a question about whether bounded rationality of various sorts – for example, unrealistic optimism, see Tali Sharot, *The Optimism Bias* (2010) – might “impeach” the numbers that emerge from revealed preference studies.

variables are involved. It is challenging, to say the least, for an automobile worker to know what the risks of his workplace are, and to incorporate that knowledge into his work-related decisions. Perhaps the aggregate numbers, working across very large populations, tell us something important, but there are behavioral questions here as well.<sup>21</sup>

In this light, we might think that a problem of nonquantifiability affects some of the most foundational decisions about valuation, which involve statistical mortality risks. Perhaps we have only ranges and probability estimates, and nothing like point estimates, there as well. For present purposes, I put these concerns to one side, noting simply that informed people would, on reflection, pay a certain amount (and no more) to eliminate statistical mortality risks, and that the empirical challenge, on which a great deal has been said, is to figure out what that amount it is.<sup>22</sup>

It is true and important, however, that if it is understood as a problem of lack of knowledge, the question of nonquantifiability operates along a continuum, and not with a simple off-on switch. Even in cases in which agencies adopt point estimates or narrow ranges, they are probably using, implicitly or explicitly, probability estimates, and this is so even if they have a high degree of confidence in their numbers. My focus on nonquantifiability is meant not to deny the existence of a continuum but to draw attention to cases in which they lack, or do not have reason for, such confidence.

2. *Three objections.* When it is objected that some regulatory benefits are not quantifiable, the central claim might be that those benefits should not be, and cannot reasonably be, turned into numerical equivalents. Consider, for example, the dignitary benefits produced by protecting personal privacy or by allowing people in wheelchairs to use public bathrooms without the assistance of others. By itself, however, this objection to quantification is ambiguous. It might take three different forms.

*First*, regulators might lack the necessary knowledge to quantify the benefits or to convert them into money. Here, then, is an *epistemic* problem: Regulators are proceeding in the presence of difficult questions of fact. They might not know how many people will benefit from a law that requires insurance companies not to deny them health insurance, or that decreases water pollution, or that reduces the risk of a financial meltdown. Alternatively, they might be able to quantify certain benefits, but they might not know how to turn them into monetary equivalents. They might not know how much people are willing to pay to obtain (or how much they would be willing to accept to give up) such benefits. Do regulators actually know how much people would be willing to pay to protect their privacy online? To reduce a risk of rape? To reduce a risk of rape in prison?

*Second*, regulators might think that even if they did know have a method for answering such questions, the resulting numbers would not be the appropriate basis for policy. For example, they might know the quantities involved, but they might believe that standard economic tools do not help with monetization. Is willingness to pay the

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<sup>21</sup> See Peter Dorman, *Markets and Morality* (1996).

<sup>22</sup> A valuable discussion is W. Kip Viscusi, *Rational Risk Policy* (1998).

appropriate measure of provision of building access to people in wheelchairs<sup>23</sup>? To protection against assault? This is an question about standard economic thinking about monetization.

*Third*, regulators might want to emphasize that human goods are diverse, not unitary, and they might conclude that (for example) human dignity is not the “equivalent” of a stated monetary sum. This is a point about *incommensurability*. The objection to quantification is that it overrides important qualitative differences among goods, and thus does violence to our considered judgments about how to think about them.

The three objections might apply to many different problems, and they require independent treatment. It is true that the lack of reliable tools can be a serious challenge, and in fact the epistemic problem is my central topic here. I shall be exploring a large number of benefits that cannot be quantified easily or at all, simply because we lack relevant information. But let us explore the second and third objections.

4. *Costs and benefits, welfare and distribution*. Suppose that we learn that people in wheelchairs would pay \$200 each year to have independent access to public bathrooms. Everyone should agree that it would make little sense to suggest that the government should provide such access but charge people in wheelchairs for the privilege. That approach would be inconsistent with the point of the Americans With Disabilities Act, which is hardly to provide antidiscrimination rights if and to the extent that disabled people are willing to pay to obtain those rights.

But here is a harder question: Does the \$200 willingness to pay mean that government should value that benefit at \$200 per person? The answer is hardly clear. Perhaps the willingness to pay figures are not entirely informative<sup>24</sup>; perhaps they do not answer the right question.<sup>25</sup> Suppose that what we care about is welfare, understood as people’s experiences of their lives (bracketing the question of what that specifically means). Suppose – a more controversial proposition – that we should aggregate the welfare effects for everyone affected by regulations, and see whether there are net welfare improvements. If so, the \$200 willingness to pay figure may not tell us what we need to know. Even if aggregated willingness to pay, based on that figure, produces benefits that are lower the monetized costs, it remains possible that independent access would give people in wheelchairs a great deal in terms of welfare, far more than those who paid the relevant amounts would lose in welfare terms.

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<sup>23</sup> The Department of Justice did explore that question in the context of an important regulation. See DEPARTMENT OF JUSTICE: DISABILITY RIGHTS SECTION OF THE CIVIL RIGHTS DIVISION, FINAL REGULATORY IMPACT ANALYSIS OF THE FINAL REVISED REGULATIONS IMPLEMENTING TITLES II AND III OF THE ADA, INCLUDING REVISED ADA STANDARDS FOR ACCESSIBLE DESIGN 142-146, available at [http://www.ada.gov/regs2010/RIA\\_2010regs/DOJ%20ADA%20Final%20RIA.pdf](http://www.ada.gov/regs2010/RIA_2010regs/DOJ%20ADA%20Final%20RIA.pdf). An excerpt is included as Appendix C.

<sup>24</sup> Jon Elster, *Sour Grapes* (1983), provides relevant discussion.

<sup>25</sup> See Martha Nussbaum, *Women and Human Development: The Capabilities Approach* (1999).

This is a point about the limitations of the willingness to pay criterion.<sup>26</sup> The conclusion is that if we monetize regulatory benefits in terms of that criterion, we might not have an adequate measure of the welfare consequences of regulations – and hence our efforts to quantify might go wrong.

Or perhaps an access requirement would promote a distributive goal: promotion of equality of opportunity for disabled people. If so, we might want to promote that goal even if the losers, from the requirement, would lose more (in terms of welfare) than the winners would win (in those terms). In my view, the willingness to pay numbers should not be decisive when we are deciding whether and how to promote distributive goals.<sup>27</sup> Note, however, that even if we insist on these points, we will have to assign *some* value to the protection of dignity; it is not possible to escape some such assignment. Perhaps the willingness to pay number is a lower bound or the place to start.<sup>28</sup> The appropriate conclusion is that standard economic tools might be the best we have for monetizing certain regulatory benefits, but the best we have may not be good enough, which means that we are back to the epistemic problem.

5. *Plural goods and incommensurability.* It is both true and important that human goods are plural rather than unitary. In his great essay on Bentham, John Stuart Mill made the point in a passage that is worth quoting at length<sup>29</sup>:

Nor is it only the moral part of man's nature, in the strict sense of the term—the desire of perfection, or the feeling of an approving or of an accusing conscience—that he overlooks; he but faintly recognises, as a fact in human nature, the pursuit of any other ideal end for its own sake. The sense of honour, and personal dignity—that feeling of personal exaltation and degradation which acts independently of other people's opinion, or even in defiance of it; the love of beauty, the passion of the artist; the love of order, of congruity, of consistency in all things, and conformity to their end; the love of power, not in the limited form of power over other human beings, but abstract power, the power of making our volitions effectual; the love of action, the thirst for movement and activity, a principle scarcely of less influence in human life than its opposite, the love of ease:— . . . . Man, that most complex being, is a very simple one in his eyes.

Because human beings are complex rather than simple, they value the goods at

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<sup>26</sup> See Sunstein, *Valuing Life*, *supra* note.

<sup>27</sup> See Adler, *supra* note.

<sup>28</sup> Cass R. Sunstein, *Cost-Benefit Analysis Without Analyzing Costs or Benefits: Reasonable Accommodation, Balancing, and Stigmatic Harms*, 74 U. CHI. L. REV. 1895 (2007). Note also the risk that if disabled people are given protection or accommodation that exceeds their willingness to pay, they might end up worse off on balance, just as in cases in which people are given any good (cars, car safety, air quality) that exceeds their willingness to pay. To come to terms with this risk, we would need to ask about whether there is a problem of bounded rationality (perhaps the good is worth a great deal, notwithstanding a relatively low willingness to pay) and also the incidence of benefits and costs (perhaps disabled workers would not have to pay much of the cost of the relevant good).

<sup>29</sup> See John Stuart Mill, "Bentham," in *Utilitarianism and Other Essays* 132 (Alan Ryan ed. 1987).



stake in regulation in qualitatively distinct ways.<sup>30</sup> To be sure, they do make tradeoffs among diverse goods,<sup>31</sup> but without valuing them in the same way. Any effort to quantify and monetize the wide range of variables involved in regulation might be seen as erasing qualitative differences among human goods. Suppose that a rule would protect human health, improve visibility, reduce risks to animals, decrease employment, and increase the costs of energy. If so, does it really make sense to align those effects along a monetary scale?

If we seek to obtain a full understanding of the various values at stake, the answer is negative. But that answer is not a decisive objection to quantification and monetization, if these are understood as an effort, not to provide that full understanding, but to ensure that we are in a good position to make tradeoffs among the relevant values. That argument for quantification is intensely pragmatic. It is important to know whether it is worthwhile to spend \$100,000, \$1 million, \$5 million, or \$20 million to achieve certain goals. Whether we are explicit about the tradeoffs or not, we will be spending a specific amount, and neither more nor less, to achieve those goals.

Quantification helps to promote accountability, transparency, and consistency, and it can also counteract both excessive and insufficient stringency. When regulators quantify and monetize relevant goods, the goal is to promote sensible tradeoffs, not to erase differences among qualitatively distinct goods. Nor should this point be unfamiliar from daily life. People pay certain amounts, and neither more nor less, on personal safety, on leisure, on children, on (what they see as) their own dignity, on health, on aesthetics, and more. They make tradeoffs, and they often use the same currency (money), even while recognizing qualitative differences among human goods. The fact of monetization is not inconsistent with a recognition of those differences. Quantification, and appropriate tradeoffs, are possible while not only recognizing but insisting on them.

## **B. The Epistemic Problem, Detailed**

Under Executive Order 13563, agencies are required to produce detailed regulatory impact analyses for economically significant rules,<sup>32</sup> and indeed, that Executive Order requires agencies “to quantify anticipated benefits and costs as accurately as possible.”<sup>33</sup> This requirement, alongside a commitment to scientific integrity, attests to the importance of both quantification and monetization. A primary goal is to ensure that regulations are based on a fair assessment of the likely consequences – on evidence and data rather than intuition, dogma, and anecdote.<sup>34</sup> But

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<sup>30</sup> See Elizabeth Anderson, *Value in Ethics and Economics* (1993).

<sup>31</sup> There is, however, a literature on “sacred values,” for which many people seem inclined to reject tradeoffs. See Martin Hanselmann and Carmen Tanner, *Taboos and Conflicts in Decision Making: Sacred Values, Decision Difficulty, and Emotions*, 3 *Judgment and Decision Making* 51 (2008).

<sup>32</sup> See Exec. Order 13,563, 76 Fed. Reg. 3821 (Jan. 18, 2011).

<sup>33</sup> *Id.*

<sup>34</sup> See Cass R. Sunstein, *Simpler: The Future of Government* (2013). For an interesting and relevant discussion of intuitions in the domain of risk, see Thorsten Pachur and Ralph Hertwig, *How Do People Judge Risks: Availability Heuristic, Affect Heuristic, or Both?*, 18 *Journal of Experimental Psychology: Applied* 314 (2012).

the same Executive Order recognizes that because of conceptual and empirical obstacles, quantification may present serious challenges. Thus the Order states that “each agency may consider (and discuss qualitatively) values that are difficult or impossible to quantify, including equity, human dignity, fairness, and distributive impacts.”<sup>35</sup> Some of these terms have long had a role in federal regulatory policy, but in this context, the words “human dignity” are entirely original, and I shall devote some attention to them here.

Both outsiders and insiders are aware that in important cases, an absence of information makes it difficult or even impossible to quantify the benefits of federal regulations.<sup>36</sup> In areas that include terrorism, financial reform, environmental protection, and civil rights, monetary values may not be easy to generate.<sup>37</sup> In the most extreme (and admittedly rare) cases, agencies may be operating under circumstances of *ignorance*, in which they cannot specify either outcomes or probabilities.<sup>38</sup> Alternatively, agencies may be operating under uncertainty rather than risk,<sup>39</sup> in the sense that they are able to identify the range of possible outcomes, but without specifying the probability that any of them will occur. They may know, for example, that a certain regulation will reduce the likelihood of terrorist attack, but they may not be able to specify the probability that such an attack will occur, or even the likely result if it does. They might know the direction of an effect, but they might be unable to say much about the magnitude. They may know that a regulation will reduce the risk of financial catastrophe, but they may not know the extent of its contribution.<sup>40</sup> They may know that a rule will reduce the number of rapes in prison, but they may not know by what amount.

In some cases, agencies might be able to specify either ranges or lower and upper bounds, without being able to offer probability estimates. They might know that a rule would save between 2000 and 4000 lives, without having a clear sense of the probability that it will save 2000, 2500, 3000, 3500, or 4000.<sup>41</sup> And in other cases, individuals may have, or believe that they have, specific knowledge about probabilities and outcomes, but government as a whole might not, in the sense that officials might not be able to achieve consensus on the relevant judgments. For example, some individuals in government might credit the studies that a rule will save 2000 lives and no more, but others might believe that those studies are not reliable -- and the government, as an institution, might lack an agreement on anything other than a range. In 2010, the government identified a social cost of carbon, but the “central value” (about \$23) was part of a range (from \$6 to

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<sup>35</sup> Id.

<sup>36</sup> For valuable discussion, see Charles Manski, *Public Policy in an Uncertain World* (2013).

<sup>37</sup> See Appendix A for numerous examples.

<sup>38</sup> See *The Precautionary Principle in the 20th Century: Late Lessons from Early Warnings* (Paul Herremoes et al. eds. 2002).

<sup>39</sup> See Frank Knight, *Uncertainty, Risk, and Profit* (1921).

<sup>40</sup> On this topic, see Eric Posner and E. Glen Weyl, *Benefit-Cost Analysis for Financial Regulation*, *Am Econ Rev* (2013).

<sup>41</sup> See the many illustrations of ranges in OFFICE OF MGMT. & BUDGET, 2012 REPORT TO CONGRESS ON THE BENEFITS AND COSTS OF FEDERAL REGULATIONS AND UNFUNDED MANDATES ON STATE, LOCAL, AND TRIBAL ENTITIES, available at [http://www.whitehouse.gov/sites/default/files/omb/inforeg/2012\\_cb/2012\\_cost\\_benefit\\_report.pdf](http://www.whitehouse.gov/sites/default/files/omb/inforeg/2012_cb/2012_cost_benefit_report.pdf)

\$66)<sup>42</sup>; in 2013, the numbers were updated, with a central value of about \$36.<sup>43</sup> No one thinks that these numbers represent the last word on the underlying questions of science and economics (or ethics). It is exceptionally challenging to attempt to identify an “expected value” with respect to the harms of climate change.<sup>44</sup>

I have noted that even when agencies are able in some sense to *quantify* the benefits of regulation, they may not be able to *monetize* those benefits. An agency may know that a rule will help to protect an endangered species by saving a specified number of its members (or at least a specified range), but it may not have confidence in any effort to turn that benefit into monetary equivalents. An agency may know that a rule will reduce water pollution, thus producing ecological benefits, but it may not know how to monetize those benefits. Perhaps an agency is able to project the number of prison rapes that will be prevented by a regulation, but it may not be confident about any effort to turn those benefits into dollars. An agency may know that a rule will reduce the risk of a terrorist attack, but it might have great difficulty monetizing the costs of such an attack, even if it can produce nonmonetary estimates for a range of potential consequences. The indirect costs of a terrorist attack (including both economic and emotional effects) make monetization exceptionally difficult.

An agency might believe that a rule would have dignitary as well as economic benefits -- for example, because it will require employers to provide reasonable accommodation to people with mental illness. Even if the agency has a sense of the number of people who will be benefited, it may not be able to monetize those benefits. To be sure, some tools are available for monetizing some hard-to-quantify benefits (as we shall see, agencies might enlist willingness to pay and contingent valuation studies), but it may not be feasible to use those tools in particular cases, and they may not be reliable even if their use is feasible.<sup>45</sup>

An agency might also be motivated by considerations of equity or fairness or by distributional considerations. For example, the Affordable Care Act forbids insurance from denying people coverage because of preexisting conditions and disallows lifetime limits on coverage. How should agencies decide whether the benefits of implementing regulations justify the costs? Executive Order 13563 expressly authorizes agencies to consider equity, fairness, and distributive impacts.<sup>46</sup> Perhaps the Affordable Care Act, and

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<sup>42</sup> Interagency Working Grp. on Social Cost of Carbon, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866 (2010), *available at* <http://www.epa.gov/oms/climate/regulations/scc-tsd.pdf>. See also Michael Greenstone et al., *Estimating the Social Cost of Carbon for Use in U.S. Federal Rulemakings* (Mass. Inst. Tech. Dep’t of Econ., Working Paper No. 11-04, 2011), *available at* [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1793366](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1793366). For assessments, see William Nordhaus, *Estimates of the Social Cost of Carbon* (Cowles Found., Discussion Paper No. 1826, 2011), *available at* <http://dido.econ.yale.edu/P/cd/d18a/d1826.pdf>; Jonathan Masur & Eric Posner, *Climate Change and the Limits of Cost-Benefit Analysis*, 99 Cal. L. Rev. 1557 (2011).

<sup>43</sup> [http://www.whitehouse.gov/sites/default/files/omb/inforeg/social\\_cost\\_of\\_carbon\\_for\\_ria\\_2013\\_update.pdf](http://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf)

<sup>44</sup> Michael Greenstone et al., *supra* note.

<sup>45</sup> See, e.g., Peter Diamond and Jerry Hausman, *Contingent Valuation: Is Some Number Better Than No Number?*, 8 J Econ Persp 45 (1994).

<sup>46</sup> See note *supra*.

other statutes that make such considerations relevant, are sufficiently prescriptive that agencies must go forward whatever the costs and benefits. In such cases, any analysis is essentially irrelevant to the ultimate decision – but under Executive Order 13563, it must nonetheless accompany economically significant rules. How shall agencies proceed to catalogue costs and benefits? What can they quantify or monetize? Perhaps they can specify the number of people who will be helped, and perhaps they can also say something about the kind of help they will receive. But will it be possible to turn those numbers into monetary equivalents?

Or suppose that the agency has a measure of discretion. It might be inclined to say that the benefits of its preferred approach, understood in terms of (say) equity, justify the costs. But how does it know if the equity benefits are sufficient to provide that justification? The agency might seek to answer by quantifying the number of people who are helped and also by specifying the extent to which they are helped. If large numbers of people are being helped, and if they are being helped in important ways (perhaps because some serious unfairness is being eliminated), the agency might start to get traction, if only because if it knows some of the most important numbers. But if it is unable to turn the elimination of unfairness into monetary benefits, how can the agency compare such numbers against (say) a cost of \$500 million<sup>47</sup>?

Of course all of these points might hold for costs as well. For example, a rule that improves scanning technology at airports might be thought to impose privacy “costs” insofar as it makes bodily images available to those who see them. Some people vigorously object to the imposition of those costs, but the agency might not be able to turn them into monetary equivalents. But because the problem of nonquantifiability is far more common for benefits than for costs, and because the underlying analysis is the same in the two contexts, I focus on benefits here.

### III. Nonquantifiability and Breakeven Analysis

Suppose that the benefits of regulations are nonquantifiable, in the sense that agencies lack information that would make quantification possible.<sup>48</sup> Within the federal government, the standard practice within the U.S. government is *breakeven analysis*.<sup>49</sup> Let us attempt to specify what breakeven analysis should entail and explore how agencies

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<sup>47</sup> Note, however, that some rules under the Affordable Care Act are essentially transfer rules, imposing costs on some for the benefit of others. It is difficult to specify the social costs and social benefits of such rules, and agencies generally do not do so. See, e.g., 2012 Report, *supra* note.

<sup>48</sup> Other understandings of nonquantifiability are explored below.

<sup>49</sup> OMB Circular A-4, which provides authoritative guidance on regulatory impact analysis, states: “It will not always be possible to express in monetary units all of the important benefits and costs. When it is not, the most efficient alternative will not necessarily be the one with the largest quantified and monetized net-benefit estimate. In such cases, you should exercise professional judgment in determining how important the non-quantified benefits or costs may be in the context of the overall analysis. If the non-quantified benefits and costs are likely to be important, you should carry out a “threshold” analysis to evaluate their significance. Threshold or “break-even” analysis answers the question, “How small could the value of the non-quantified benefits be (or how large would the value of the non-quantified costs need to be) before the rule would yield zero net benefits?” In addition to threshold analysis you should indicate, where possible, which non-quantified effects are most important and why.”

should use it in deciding whether and how to proceed.

### A. Ordinary Life

It will be useful to clarify the practice before we begin. Suppose that you are deciding whether to take a vacation in Ireland, to drive to an adjacent state in order to purchase a desirable product, or to join a sports club. In all of these cases, you might have a clear sense of the costs but only a vague sense of the benefits, which may not be quantifiable. You might think: *What would the benefits have to be, in order to justify the costs?* Breakeven analysis, thus understood, plays a significant role in ordinary life.

It plays a role in business as well. Suppose that a real estate investment company does not know for how much certain apartments will rent, but it does know that other, less desirable apartments in the area rent for \$900 per month. Suppose too that the company knows that the investment will be worthwhile if it can rent its apartments for more than \$800 per month. If so, it makes sense to proceed. Or consider the decision whether to purchase insurance in circumstances in which potential purchasers cannot quantify the probability of a bad outcome. In deciding whether to proceed, potential purchasers might well engage in a kind of informal breakeven analysis.

Three qualifications are necessary. First, it is true that for some decisions, it might not make sense to make a full assessment, or indeed any assessment, of the reasons for or against action. The costs of making that assessment might be prohibitive, at least in light of what people know. In such cases, people might pick rather than choose – an important idea, pressed by Edna Ullmann-Margalit and Sidney Morgenbesser,<sup>50</sup> that captures the fact that calculation may be too complex to be worth the trouble. In ordinary life, picking is common. Life is short, and if we were always to choose, we would quickly run out of time. Matters are more complicated for government agencies. If an agency picks, and does not choose, it will certainly have some explaining to do. Under standard assumptions, picking would be arbitrary and unlawful for that reason<sup>51</sup> – but the standard assumptions might not always hold (a point to which I shall return).

Second, it is also true that in some personal contexts, any effort at calculation, at least if it is explicit, would be in grave tension with the best understanding of the relationships involved. Suppose that you are considering how much to spend on a final vacation with a spouse who is fatally ill. If you love your spouse, you are unlikely to turn everything you can into monetary equivalents, and to use breakeven analysis where you cannot. Perhaps you will do something like that implicitly. But if you do it explicitly, you will be thinking about your spouse in ways that will be in grave tension with your love for her.

Third, some very large decisions might promise, or threaten, to transform your

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<sup>50</sup> See Edna Ullmann-Margalit and Sidney Morgenbesser, Picking and Choosing, 44 Social Research 757 (1977)

<sup>51</sup> For a powerful set of objections, see Adrian Vermeule, Rationally Arbitrary Decisions (in Administrative Law), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2239155](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2239155) (2013).

life, including your preferences and your values, and it might be difficult or even impossible to use any kind of cost-benefit analysis, or to invoke breakeven analysis, to obtain a sense of what to do.<sup>52</sup> If your decision will alter your future self, it might be very difficult to get traction on that analysis. Perhaps a suitable understanding of welfare will help, but it might operate at a high level of generality and abstraction that makes it less than useful. In Ullmann-Margalit's formulation, you might simply "opt," at least when your "inner core of beliefs and desires does not simply gradually evolve but undergoes, instead, an abrupt transformation."<sup>53</sup> There are analogies to the idea of opting in the regulatory context as well, at least where agencies, or governments, are making fundamental decisions about their future in which their basic values are at stake, and when they are unequipped with helpful numbers.

### **B. Conditional Cost-Benefit Analysis: Three Suggestions**

When benefits cannot be quantified, breakeven analysis is a significant part of federal agency practice.<sup>54</sup> Agencies should, and often do, respond to nonquantifiable benefits by engaging in a kind of *conditional cost-benefit analysis*, stating that the benefits would justify the costs if certain assumptions hold and certain conditions are met.<sup>55</sup> The problem is that the practice has thus far remained largely unanalyzed, and its uses and limitations remain unclear. In the context of rear visibility, for example, the Department of Transportation relied heavily on nonquantifiable benefits, but it did not engage in formal breakeven analysis, and it is not entirely clear what that form of analysis would look like. Did it pick? Did it opt? I offer three suggestions to help discipline the operation of breakeven analysis.

My first suggestion is that breakeven analysis *is most helpful when agencies are able to identify either a lower or upper bound for regulatory benefits, with either point estimates or with estimates of expected value*. In such cases, agencies might say that a regulation with an annual cost of \$200 million, but with nonquantifiable benefits, is justified if and because the lower bound for such benefits is at least \$200 million. It should be clear that when lower bounds can be specified, agencies are faced with only partial nonquantifiability. Uses of breakeven analysis frequently depend on an implicit understanding to this effect. Agencies have generally not made that understanding explicit. I suggest that they should do so.

When lower or upper bounds cannot be specified in any way, it might be objected that breakeven analysis is not much more than a description or a hunch – or (when an agency decides to proceed) a shorthand way of announcing that the agency is in favor of precautions. But even without lower or upper bounds – and this is my second suggestion - *- breakeven analysis can be made more tractable if agencies draw comparisons with cases in which monetary values have previously been assigned*. For example, the value of

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<sup>52</sup> See Edna Ullmann-Margalit, *Big Decisions: Opting, Converting, Drifting*, 58 *Royal Institute of Philosophy* 157 (2006).

<sup>53</sup> *Id.* at

<sup>54</sup> See Appendix A.

<sup>55</sup> See *id.*

a statistical life is now around \$9 million.<sup>56</sup> When dealing with nonquantifiable benefits, that value can help to orient judgment about whether to proceed. In fact the value of a statistical life might provide an upper bound for an assortment of regulatory benefits (including harms that fall short of death), and in this way, the comparison can make breakeven analysis more useful. Agencies have assigned monetary values to a number of other benefits,<sup>57</sup> and those assignments might provide helpful orientation when they deal with nonquantifiable benefits.

These points suggest a simple framework for use in dealing with nonquantifiable benefits. When quantified benefits justify quantified costs, of course, agencies should proceed (to the extent permitted by law).<sup>58</sup> When quantified benefits do not justify quantified costs, but when nonquantifiable benefits are involved, agencies should identify those benefits and, to the extent possible, identify lower and upper bounds. They might be able to do so because of existing information about the problem at hand or because of relevant information from comparison cases. After lower and upper bounds have been identified, agencies should add that information to the benefits estimate, and to the extent permitted by law, proceed if the benefits justify the costs (and not if otherwise).

In some situations, however, agencies will not be able to identify lower and upper bounds in any way, and comparison cases are not available. My third suggestion is that in such situations, *breakeven analysis will be helpful largely insofar as it explains what information is missing and why some cases are especially difficult*. In these situations, a particular feature of breakeven analysis is the specification of the conditions under which benefits would, in fact, justify costs. If the absence of information makes the specification less than decisive for purposes of decision, at least it will be useful in identifying the assumptions under which the benefits would justify the costs. As we will see, this kind of conditional justification plays a significant role in current practice.

#### IV. The Practice: Illustrative Cases

As noted, the central goal of breakeven analysis is straightforward. It is to pose this question: How high would the benefits have to be, in order for the costs to be justified? Those who engage in such analysis hope that however simple, that question will help agencies to answer otherwise intractable questions. To orient the discussion, here are seven applications. The examples are highly stylized, but each of them draws very closely on actual uses of breakeven analysis (see Appendices A and C).

1. A regulation is designed to protect clean water. It costs \$200 million. The benefits, which are ecological and do not involve human health, cannot be quantified. The agency does not know exactly what the benefits will be (except at a certain level of

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<sup>56</sup> See, e.g., Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses (2013), available at <http://www.dot.gov/regulations/economic-values-used-in-analysis>.

<sup>57</sup> See Appendix B.

<sup>58</sup> Also to the extent permitted by law, they should select the approach that maximizes net benefits.

generality); on the basis of current knowledge, it cannot specify them. It certainly is unable to monetize those benefits. Nonetheless, the agency is inclined to believe that the nonquantifiable benefits are likely to be substantial and may well justify the costs. Under breakeven analysis, relevant questions would be: How many water bodies would be affected? What kinds of improvements can be expected? What would those improvements actually achieve? Would they help human beings, and if so how?

Suppose that there are only twenty relevant water bodies, that they are relatively small, that they lack a great deal of aesthetic or recreational importance, that human health is not involved in any way, and that for each of those water bodies, the improvement in water quality, while real, would be modest. Under breakeven analysis, an expenditure of \$200 million would not be easy to defend. The question would be: On what assumptions is it worthwhile to spend \$10 million per water body for such apparently modest improvements? Unless there is a reasonable answer to this question, the agency is likely to elect not to proceed. Now suppose that there are 200,000 such water bodies, that some of them are very large, and that the improvement in water quality would be substantial, with attendant ecological benefits (including significant recreational benefits). Under those assumptions, much more would have to be said to obtain a full picture. But the argument for proceeding would be plausible under breakeven analysis as it is ordinarily used, and the agency might well go forward.

2. The agency is imposing a new disclosure requirement on the automobile industry, designed to ensure greater clarity about the economic and environmental benefits of increased fuel economy.<sup>59</sup> The cost of the requirement is \$15 million. The agency knows (on the basis of evidence) that with the new requirement, the public will have a significantly better understanding of those benefits and thus be able to make more informed decisions and to save money. The agency believes that the social gains will be substantial, especially in light of the fact that it anticipates sales of over 12 million cars annually. At the same time, it is not able to specify those social gains. The agency does not know how to monetize more informed decision-making as such, and it does not know how much consumers will save as a result of the new requirement. But the agency is inclined to conclude that under breakeven analysis, the

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<sup>59</sup> Cf. Revisions and Additions to Motor Vehicle Fuel Economy Label, 76 Fed. Reg. 39,478, 39,480 fig.I-1 (2011) (to be codified at 40 C.F.R. pts. 85, 86, and 600).



requirement is justified, because millions of people are likely to incorporate the information and to save money.

3. An agency is issuing a regulation designed to reduce the incidence of prison rape.<sup>60</sup> The annual cost of the regulation is \$470 million. The agency cannot specify the number of prison rapes that the regulation will prevent. In addition, it believes that its efforts to monetize the costs of prison rapes – suggesting a value between \$300,000 and \$600,000 million -- are speculative and tentative. Under breakeven analysis, it nonetheless decides to go forward. It finds that at least 160,000 prison rapes occur every year, and it concludes that if a single rape is valued at \$500,000, the rule would be justified if it prevented only 1600 rapes, about 1 percent of the total. It believes that the rule is highly likely to achieve that goal.
4. The annual cost of an animal welfare regulation, issued under the Animal Welfare Act, would be \$200 million. The regulation would have no easily monetized benefits. Its principal benefits would accrue to animals, in the form of longer and healthier lives (and let us stipulate far less suffering as well). One possibility would be to use stated preference studies to obtain monetary equivalents, though it would be challenging to make such studies credible and reliable,<sup>61</sup> and though the agency does not believe that the results of any such study would fully capture the benefits of its regulation (which would accrue principally to animals, not people). Another possibility would be to engage in breakeven analysis here as well. As before, a degree of quantification may be helpful short of monetization. Would there be benefits for human beings? Of what kind? How many animals would be helped? A very large number? How much would they be helped? A great deal? The agency believes that answers to those questions would prove to be clarifying.
5. A regulation is designed to reduce the risk of a financial crisis by stabilizing the financial system.<sup>62</sup> Its annual costs are projected to be \$600 million. The agency states that the regulation will make a crisis less likely, but it cannot quantify the extent of the effect. In its analysis, the agency describes the cost of a crisis, if it should occur, and adds that if the rule reduces the risk even by a very small percentage (which is specified), its benefits will justify its costs. The agency also

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<sup>60</sup> Cf. National Standards to Prevent, Detect, and Respond to Prison Rape, 77 Fed Reg. 37,105, 37,111 (June 20, 2012) (to be codified at 28 C.F.R. pt. 115).

<sup>61</sup> See note supra.

<sup>62</sup> For valuable discussion, see Posner and Weyl, supra note.

explains why its regulation would contribute to that reduction. Under the circumstances, the agency thinks that a form of breakeven analysis is the best that can be done. Having offered that analysis, with an account of the costs of a crisis and the potential contribution of the rule to reducing the underlying risk, it is inclined to proceed.

6. A regulation is designed to reduce the risk of a successful terrorist attack by requiring improved scanning technology at airports. The cost of the technology is \$900 million. The Transportation Security Administration is unable to quantify the benefits. It notes, however, that the cost of even a single terrorist attack can be far in excess of \$900 million. Applying breakeven analysis, the agency concludes that the requirement is justified. It states that even if the probability of an averted terrorist attack is very small, the benefits justify the costs in light of the extraordinary cost of such an attack. It offers some rough numbers to support that conclusion.
7. A regulation costs \$500 million. Its goal is to make buildings more accessible to people who use wheelchairs.<sup>63</sup> The monetized benefits of the regulation are \$450 million. The agency contends that the regulation will promote human dignity, for example by allowing wheelchair-bound workers to have access to bathrooms. It cannot monetize the dignitary value of the regulation. It does not have willingness to pay studies in this domain, and it is skeptical about the idea that the results of those studies would be sufficiently informative. But applying breakeven analysis, it concludes that the regulation is justified, because the dignitary value is at least \$50 million.<sup>64</sup>

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<sup>63</sup> Cf. Nondiscrimination on the Basis of Disability in State and Local Government Services; Final Rules, 75 Fed. Reg. 56,163, 56,170 (Sept. 15, 2010) (to be codified at 28 C.F.R. pts. 35, 36).

<sup>64</sup> In an analogous rule, the Department stated as follows:

[T]he additional benefits that persons with disabilities will derive from greater safety, enhanced independence, and the avoidance of stigma and humiliation--benefits that the Department's economic model could not put in monetary terms--are, in the Department's experience and considered judgment, likely to be quite high. Wheelchair users, including veterans returning from our Nation's wars with disabilities, are taught to transfer onto toilets from the side. Side transfers are the safest, most efficient, and most independence-promoting way for wheelchair users to get onto the toilet. The opportunity to effect a side transfer will often obviate the need for a wheelchair user or individual with another type of mobility impairment to obtain the assistance of another person to engage in what is, for most people, among the most private of activities. . . . [I]t is important to recognize that the ADA is intended to provide important benefits that are distributional and equitable in character. These water closet clearance provisions will have non-monetized benefits that promote equal access and equal opportunity for individuals with disabilities." Id.

Note that the Department also spoke explicitly of breakeven analysis, in a passage that is worth

## V. Specifying the Framework

To be sure, the cases just given are different from one another. In all of them, quantification is difficult or impossible, and the epistemic problem is serious, but the underlying reasons are divergent. Whatever the source of the problem, the appeal of breakeven analysis is not obscure. By hypothesis, standard cost-benefit analysis is not possible. In the absence of such analysis, the agency calculates the costs and offers a judgment about the conditions under which the benefits would justify them, along with an explanation of that judgment. Recall the ordinariness of a rough form of breakeven analysis in ordinary life, and also its uses in business. The challenge is to understand the underlying structure of that analysis and to see how it might be made both useful and disciplined.

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quoting at length:

The requirements relating the water closet clearances are among the most costly (in monetary terms) of the new provisions. Although the *monetized* costs of these requirements substantially exceed the *monetized* benefits, the benefits that have not been monetized (avoiding stigma and humiliation, protecting safety, and enhancing independence) are expected to be quite high. . . .

We estimate that the costs of the requirement as applied to out-swinging doors will exceed the monetized benefits by \$454 million, which when annualized over 54 years equals a net cost of approximately \$32.6 million a year.

We estimate that people with the relevant disabilities will use a newly accessible single-user toilet room with an out-swinging door approximately 677 million times per year. Dividing the \$32.6 million annual cost by the 677 million annual uses, we conclude that for the costs and benefits to break even in this context, people with the relevant disabilities will have to value safety, independence, and the avoidance of stigma and humiliation at just under 5 cents per use.

There are substantially fewer single-user toilet rooms with in-swinging doors, and substantially fewer people with disabilities will benefit from making those rooms accessible. And the alterations costs to make a single-user toilet room with an in-swinging door accessible are substantially higher (because of the space taken up by the door) than the equivalent costs of making a room with an out-swinging door accessible. Thus, we calculate that the costs of applying the toilet room accessibility standard to rooms with in-swinging doors will exceed the monetized benefits of doing so by \$266.3 million over the life of the regulation, or approximately \$19.14 million per year when annualized over 54 years.

We estimate that people with the relevant disabilities will use a newly accessible single-user toilet room with an in-swinging door approximately 8.7 million times per year. Dividing the \$19.14 million annual cost by the 8.7 million annual uses, *we conclude that for the costs and benefits to break even in this context, people with the relevant disabilities will have to value safety, independence, and the avoidance of stigma and humiliation at approximately \$2.20 per use.*

DEPARTMENT OF JUSTICE: DISABILITY RIGHTS SECTION OF THE CIVIL RIGHTS DIVISION, FINAL REGULATORY IMPACT ANALYSIS OF THE FINAL REVISED REGULATIONS IMPLEMENTING TITLES II AND III OF THE ADA, INCLUDING REVISED ADA STANDARDS FOR ACCESSIBLE DESIGN 142-143, available at [http://www.ada.gov/regs2010/RIA\\_2010regs/DOJ%20ADA%20Final%20RIA.pdf](http://www.ada.gov/regs2010/RIA_2010regs/DOJ%20ADA%20Final%20RIA.pdf) (emphasis added). Relevant additional discussion, including estimates of the value people with disabilities place on avoiding stigma (based on revealed-preference studies), can also be found in the Regulatory Impact Analysis. See Appendix C.

A cautionary note before we begin: It might be thought that the purpose of regulation is to protect rights, that rights cannot be made part of a quantitative exercise, and that when rights are at risk, they impose side-constraints on what might be done. On this view, deontological constraints matter and cannot easily or properly be made part of cost-benefit analysis. If so, the problem of nonquantifiability is, in a sense, a happy one, because it helps to focus us on what is actually at stake. In some contexts, these claims may be correct; consider the prohibition of torture.<sup>65</sup> But in the cases at issue here, the claims are not helpful. To be sure, it is not unintelligible to say that rights are involved in these cases. We are dealing, among other things, with life, bodily integrity, and discrimination. But even in those contexts, tradeoffs are inevitable, and some kind of monetary valuation is inevitable as well.

### **A. Easy Cases, Hard Cases**

Before elaborating these ideas, let us simply observe that under the suggested approach, some cases do seem genuinely easy. Suppose that a rule would cost \$1 billion and that the nonquantifiable benefits would be modest in individual cases and accrue to a very small set of beneficiaries -- for example, by improving disclosure to them about potential economic savings from a particular energy-efficient appliance. Unless there are special circumstances, the expenditure does not seem worthwhile. To be sure, the number of beneficiaries may not be decisive if each of them receives a great deal, but if the value of a statistical life is \$9 million, it will be hard to justify an expenditure of \$1 billion to benefit a very small group. And if a rule would cost merely \$10,000 and if the nonquantifiable benefits are real and would accrue to a very large group, it would probably make sense to move forward.

When cases are difficult, a virtue of breakeven analysis is that it helps to explain why, exactly, that is the case. If a rule would reduce the risk of a financial crisis by some nonquantifiable amount and cost \$500 million, the reason for the difficulty is clear. And if a rule would cost \$500 million but produce \$450 million in monetizable benefits by enabling people in wheelchairs to have easier access to bathrooms, the \$50 million shortfall might turn out to raise hard questions. The question would be: What are the nonquantifiable benefits that might make up the difference? As we shall see, it may well be feasible to provide an answer.

### **B. Floors and Ceilings: Point Estimates and Expected Value**

It would be possible to insist that when breakeven analysis turns out to be helpful, there must be at least a degree of quantification. An agency may not be able to specify benefits, but it might have a sense (perhaps intuitive, perhaps more formal than that) of a lower or upper bound – and that sense may be doing the real work in breakeven analysis.

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<sup>65</sup> See Jeremy Waldron, *Torture, Terror, and Tradeoffs* (2012). But see Cass R. Sunstein, *Moral Heuristics*, 28 *Behavioral and Brain Sciences* 531 (2005) (suggesting the possibility that certain seemingly absolute moral injunctions should be understood as heuristics, in the sense of mental shortcuts for a full consequentialist analysis).

1. *Point estimates.* Suppose that a rule would cost \$1 million and prevent, as a lower bound, twenty incidents of prison rape. We might be able to say that the lower (monetary) bound, in terms of prevention of a single prison rape, is certainly over \$300,000 million, and hence the rule is easily justified. When an agency says that a rule survives breakeven analysis, it is often saying that the rule's benefits have a floor, in the form of a sufficiently high lower bound. In individual lives and in business decisions, breakeven analysis often works in precisely that way. The same is true in government.

Suppose, by contrast, that a rule would cost \$500 million and prevent only a few cases of relatively harmless water pollution. In that case, the higher bound would not justify the rule. Or suppose that the cost of a financial crisis is \$1 trillion and that the cost of a regulation, designed to reduce the risk of such a crisis, is \$5 billion. With these numbers, the agency might decide that the probability that the regulation will avoid a crisis is at least or at most  $1/n$ , and if  $n$  can be specified, or if some kind of range is possible, the agency will have a better sense of whether to proceed.

When an agency says that a rule does not survive breakeven analysis, it is likely saying that the benefits have a ceiling. The upper bound of the benefits of the rule is insufficiently high to justify the rule. It follows that breakeven analysis is most useful when the agency is able to quantify and monetize the floors or ceilings of the relevant benefits. If so, it might nonetheless have a great deal of difficulty in deciding which approach maximizes net benefits, but at least it should be in a good position to say whether benefits justify costs.

Within this framework, we could imagine different degrees of knowledge, precision, and candor. In the most straightforward cases, the agency is actually able to identify a point estimate for the lower or upper bound. In such cases, its conclusion – that the regulation is or is not justified -- is reliable and not speculative (so long as the numbers can be trusted). The uncertainty exists in producing a point estimate or possibly even a range beyond the relevant bound.

2. *Expected value.* In other cases, the agency cannot make a point estimate, but it can describe the range of benefits at the lower and upper ranges, and perhaps specify an expected value at the low and high ends. Suppose, for example, that the cost of a rule is \$100 million, and that at the low end, the benefits range from \$80 million to \$300 million. (This example might be realistic if the agency can quantify but not monetize the benefits.) If the agency can produce a probability distribution,<sup>66</sup> the ultimate judgment

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<sup>66</sup> OMB Circular A-4 states:

Whenever possible, you should use appropriate statistical techniques to determine a probability distribution of the relevant outcomes. For rules that exceed the \$1 billion annual threshold, a formal quantitative analysis of uncertainty is required. For rules with annual benefits and/or costs in the range from 100 million to \$1 billion, you should seek to use more rigorous approaches with higher consequence rules. This is especially the case where net benefits are close to zero. More rigorous uncertainty analysis may not be necessary for rules in this category if simpler techniques are sufficient to show robustness. You may consider the following analytical approaches that entail increasing levels of complexity:

might be tractable even if, at the middle and higher ends, the agency is at sea.

To be sure, assessment of expected values might present serious empirical challenges, especially in cases of the kind I have outlined. In most cases, agencies are unlikely to have anything like a probability distribution.<sup>67</sup> It may well be important to examine the question of density and to explore how often the benefits may fall below the breakeven point. Even when agencies do not have a full probability distribution, however, they may have a sufficient if rough sense of expected value, one that enables them to decide whether to proceed.

### C. Nonquantifiable vs. Nonmonetizable

1. *Quantification without monetization.* Suppose that the agency is able to quantify the benefits but not to monetize them. For example, it might know a great deal about the effects of regulations designed to protect water quality, to reduce prison rape, and to protect privacy or wheelchair access, in the sense that it might know how many people will be affected, and also how they will be affected. But even if it can specify those effects, it may not know how to turn them into monetary equivalents. Is breakeven

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- Disclose qualitatively the main uncertainties in each important input to the calculation of benefits and costs. These disclosures should address the uncertainties in the data as well as in the analytical results. However, major rules above the \$1 billion annual threshold require a formal treatment.
  - Use a numerical sensitivity analysis to examine how the results of your analysis vary with plausible changes in assumptions, choices of input data, and alternative analytical approaches. Sensitivity analysis is especially valuable when the information is lacking to carry out a formal probabilistic simulation. Sensitivity analysis can be used to find "switch points" -- critical parameter values at which estimated net benefits change sign or the low cost alternative switches. Sensitivity analysis usually proceeds by changing one variable or assumption at a time, but it can also be done by varying a combination of variables simultaneously to learn more about the robustness of your results to widespread changes. Again, however, major rules above the \$1 billion annual threshold require a formal treatment.
  - Apply a formal probabilistic analysis of the relevant uncertainties B possibly using simulation models and/or expert judgment as revealed, for example, through Delphi methods. Such a formal analytical approach is appropriate for complex rules where there are large, multiple uncertainties whose analysis raises technical challenges, or where the effects cascade; it is required for rules that exceed the \$1 billion annual threshold. For example, in the analysis of regulations addressing air pollution, there is uncertainty about the effects of the rule on future emissions, uncertainty about how the change in emissions will affect air quality, uncertainty about how changes in air quality will affect health, and finally uncertainty about the economic and social value of the change in health outcomes. In formal probabilistic assessments, expert solicitation is a useful way to fill key gaps in your ability to assess uncertainty. In general, experts can be used to quantify the probability distributions of key parameters and relationships. These solicitations, combined with other sources of data, can be combined in Monte Carlo simulations to derive a probability distribution of benefits and costs. You should pay attention to correlated inputs. Often times, the standard defaults in Monte Carlo and other similar simulation packages assume independence across distributions. Failing to correctly account for correlated distributions of inputs can cause the resultant output uncertainty intervals to be too large, although in many cases the overall effect is ambiguous. You should make a special effort to portray the probabilistic results—in graphs and/or tables—clearly and meaningfully.

<sup>67</sup> But see proposed rule on greenhouse gas emissions from new power plants.

analysis helpful in such cases?

As before, the easiest problems arise when monetary equivalents have a lower bound. Suppose that we have reason to believe that the lowest value for prevention of a prison rape is \$300,000. If so, perhaps that is all we need to know to find that the benefits justify the costs. The same is true in cases of upper bounds. If a statistical life is worth \$9 million, then that amount, or something below it, might serve as an upper bound for a wide variety of injuries and diseases. When quantification is possible but monetizable is not, lower bounds and upper bounds might nonetheless be feasible. And even if they are not, perhaps it is possible to generate expected values or lower and upper bounds.

2. *Monetization without quantification.* More subtly, breakeven analysis might be helpful when agencies can monetize benefits but cannot quantify them. Suppose that an agency knows that in each case, a “benefit unit” is worth \$5000, but that it cannot specify the number of units that a regulation will produce. Even when this is so, perhaps the agency can specify lower or upper bounds with respect to the number of units. An agency might know that the regulation will produce at least 10,000 benefits units, or that it will produce at most 5,000 of them. Or perhaps the agency cannot make point estimates but can produce expected values with respect to benefits units. If so, it might be able to use breakeven analysis when monetization is possible and when quantification is not.

#### **D. Comparisons**

Is breakeven analysis at sea in the absence of lower and upper bounds? At first place, it might seem so -- but perhaps not. As we have seen, agencies might engage in a series of comparisons that help to discipline the analysis. Generalizing from the example of the value of a statistical life, they might examine monetary equivalents that are well-established, and compare those to the nonquantifiable benefits at hand.

For example, it would be hard to defend an approach that would value a modest improvement in water quality at the same level as a human life. It would also be hard to defend an approach that would value the life of a sea otter at the same level as a human life. An agency might not know the monetary value of protection of human dignity through wheelchair accessibility, but it would seem extravagant to assign a value in excess of the value of human life. By comparing nonmonetizable benefits to those benefits that have been monetized, agencies might be able to use breakeven analysis to gain traction in difficult cases.

In fact agencies have a significant comparison set on which to draw, certainly in the domain of health. For example, EPA values a nonfatal heart attack between \$100,000 and \$200,000; cardiovascular problems at \$42,000; chronic lung disease at \$21,000; and an emergency visit for asthma at \$430.<sup>68</sup> For purposes of breakeven analysis, it would be possible to draw on such figures to make more informed choices. (See Appendix B for a

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<sup>68</sup> See Table 5-9 of the Final Regulatory Impact Analysis for Particulate Matter, available at <http://www.epa.gov/ttn/ecas/regdata/RIAs/finalria.pdf> (2013).

number of recent valuations.)

### **E. Sparse Knowledge, Conditional Justifications, and Judgments of Value**

It is evident that the hardest cases will arise when agencies cannot produce floors, ceilings, or expected values, when neither quantification nor monetization is possible, and when comparisons are not helpful. In such cases, agencies use breakeven analysis to produce *conditional justifications*, which may not resolve the question whether they should go forward (see Appendix A), and which have the virtue of providing information about what is missing, and about what kinds of assumptions would be necessary to provide a basis for proceeding. (Of course it remains true that agencies must proceed if the law requires them to do so, whatever the outcome of cost-benefit analysis.)

Consider a water pollution regulation that would cost \$200 million while producing ecological benefits that cannot be either quantified or turned into monetary equivalents. The case would be more tractable if the agency knows (1) that the number of benefited water bodies is either small or large, (2) that the benefited water bodies are important (in some relevant sense) or not, and (3) that the improvements in water quality are either de minimis or very large. But if the answers to these questions are unclear, how shall it proceed? Or return to the case of financial regulation and suppose that a rule would cost \$500 million and that it would contribute, in a way that cannot be specified, to reduction of the risk of a financial crisis. If the agency decides to go forward with the rule on the ground that the benefits justify the costs, it is essentially opting for precaution,<sup>69</sup> relying on a hunch, or stating the conclusion. The same is true if the case involves protection against the risk of terrorist attack.

Critics might object that in cases of this kind, breakeven analysis is not useful, because it cannot do relevant work and is giving the agencies no traction in deciding whether to go forward. On the most extreme version of this objection, agencies might as well flip a coin, or instead “pick,” at least until they acquire additional information.<sup>70</sup> Perhaps breakeven analysis draws attention to the need to acquire that information, and might in some ways be information-forcing, but in the absence of such information, the analysis cannot offer much help.

The objection has considerable force. But defenders of breakeven analysis might respond in the following way. Some cases are genuinely hard.<sup>71</sup> On the basis of what the agency knows, neither action nor inaction is readily justified. The reason is that crucial

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<sup>69</sup> For relevant discussion, see Edna Ullmann-Margalit, *Big Decisions: Opting, Converting, Drifting*, 58 *Royal Institute of Philosophy Supplement* 157 (2006).

<sup>70</sup> Cf. Adrian Vermeule, *Rationally Arbitrary Decisions* (in *Administrative Law*) (unpublished manuscript 2013).

<sup>71</sup> Though I am bracketing them for purposes of this discussion, questions of reversibility are also highly relevant here. See generally Kenneth J. Arrow & Anthony C. Fisher, *Environmental Preservation, Uncertainty, and Irreversibility*, 88 *Q.J. Econ.* 312 (1974); Anthony Fisher, *Uncertainty, Irreversibility, and the Timing of Climate Policy* 9 (2001). An agency might decide to act or not to act while it obtains more information; whether and in what sense the decision is reversible bears on that decision. See Cass R. Sunstein, *Irreversibility*, 9 *Law, Probability and Risk* 227 (2010).



information is absent.<sup>72</sup> To be sure, agencies should work to acquire that information, but if it is lacking, they must be candid about that fact. When they exhaust the limits of what they know and are uncertain whether to proceed, at least breakeven analysis helps them to specify the source of uncertainty, and what they would need to know in order to reduce it.<sup>73</sup> Moreover, and importantly, conditional justifications have the advantage of transparency, because they specify the factual assumptions that would have to be made for the benefits to justify the costs. That specification is exceedingly important, because it can promote accountability, because it can promote consideration of the plausibility of those assumptions, and because it can also promote testing and revisiting over time as new information becomes available.<sup>74</sup>

## F. Testing Cases

To see how the suggested approach might work in practice, let us turn to some especially difficult cases, pressing the limits of quantification.

1. *Rear visibility.* We began with the rear visibility regulation. As noted, the agency referred to a series of nonquantifiable values, but it did not engage in breakeven analysis. How might its analysis have been made more disciplined?

The crudest form of breakeven analysis would have noted that the monetized shortfall was in the vicinity of \$200 million, and so the question was whether the nonquantifiable values could make up the difference. Taken in the abstract, and without saying more, that question is difficult to answer. But the Department of Transportation might have made more progress by saying a bit more about the relevant values.

For example, the Department properly referred to the increased ease and simplification of driving. Suppose that the relevant improvement is valued at merely \$30, taken as a reasonable lower bound.<sup>75</sup> Suppose too that the regulation would apply to 60,000 cars that would otherwise lack cameras. If so, it would produce \$180 million in additional benefits. At that point, the monetized benefits become very close to the monetized costs. By itself, we are very close to the breakeven point.

The Department might have also noted that some work suggests that parents value

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<sup>72</sup> See Fisher, *supra* note.

<sup>73</sup> Valuable discussion can be found in Ullmann-Margalit, *supra* note.

<sup>74</sup> Note the close connection between this point and the “regulatory lookback” required by Executive Order 13563. Retrospective analysis might well be able to shed light on whether the regulation with nonquantifiable benefits is in fact delivering sufficient benefits. See Sunstein, Simpler, *supra* note; Michael Greenstone, *Toward a Culture of Persistent Regulatory Experimentation and Evaluation*, in *NEW PERSPECTIVES ON REGULATION* 113, 113 (David Moss & John Cisterno eds., 2009).

<sup>75</sup> For many cars, the cost of a rearview camera would be in the vicinity of \$45, which raises a question why many consumers do not appear willing to pay that amount. But we should be careful before concluding that their failure to do so is decisive. It may be that the unfamiliarity of the technology is an obstacle; it may be that once people use the cameras, they learn that they are worth (at least) that amount. Here as elsewhere, there may be a difference between “decision utility” (the expected utility at the same of decision) and “experienced utility” (the actual utility). The latter deserves priority, though public officials may not be reliable in their judgments about it.

a young child's life at \$18 million<sup>76</sup> – a number that would add \$45 million to its existing benefits figure. At that point, the benefits and costs are essentially equivalent. And indeed, that \$18 million figure captures the parents' valuation of children's lives, not children's valuation of their lives. It would have been an unusual step, but the Department might have undertaken a sensitivity analysis with values of \$18 million and \$27 million – with the latter adding \$90 million, leaving a shortfall of \$110 million. Recall finally that we are speaking here of parents who would not only (only!) lose their children, but who would also be directly responsible for that loss. How much would it be worth to reduce the risk of that eventuality?

With analysis of this kind, the Department's conclusion seems entirely reasonable – not because of a list of nonquantifiable benefits, but because once we begin to speak of lower bounds and expected ranges, an apparently intractable puzzle begins to dissolve, or at least to look far more tractable.

2. *Prison rape.* Let us suppose that the cost of a rule, designed to reduce the risk of prison rape, is \$500 million. Let us also suppose that every year, there are 260,000 prison rapes in the United States. How should the Department of Justice analyze the benefits? The case would be especially interesting if (as seems likely) variations on the rule, more and less stringent, would increase and decrease both costs and benefits, but let us bracket that possibility.

Consistent with the discussion here, the simplest analysis would ask what the benefits would have to be to justify that \$500 million expenditure. To get traction on that question, the Department might want to try to specify the number of prison rapes that its rule will prevent and also the monetary value of a case of prevented rape. If it expects to prevent 10,000 rapes, and if each rape is valued at \$500,000, the benefits would be \$5 billion – easily enough to justify the regulation. Of course the Department would need to have some basis for those projections.

Here is what the Department actually did.<sup>77</sup> It began by attempting to identify the value of a case of prevented rape. It used two methods to do so. First, it relied on a contingent valuation study that asked citizens, in a particular region of the United States, how much they would be willing to pay to prevent a case of rape. That study elicited a value of about \$310,000 per victim, reflecting the willingness to pay of “society.” Second, it examined compensation measures from the legal system, finding a value of about \$480,000, with a \$670,000 for juveniles. With these numbers, it generated a range of values for the prevention of a cases of prison rape.

The Department did not specify the number of rapes that it expected to prevent, but it did note that the total monetizable cost of prison rape and sexual abuse is about \$46.6 billion annually for prisons and jails, and an additional \$5.2 billion annually for juvenile facilities. The Department concluded that if its rule prevented just 1,671 of the

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<sup>76</sup> See Sean Williams, *Statistical Children* (2012), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2176463](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2176463)

<sup>77</sup> [http://ojp.gov/programs/pdfs/prea\\_ria.pdf](http://ojp.gov/programs/pdfs/prea_ria.pdf)

260,000 annual prison rapes, its benefits of the rule would exceed its costs.<sup>78</sup>

This analysis is generally in line with that suggested here, but we need to add several qualifications. First, the Department would have done well to explain why it believed that its rule would prevent at least that number of prison rapes, or why 1,671 could be seen as a reasonable lower bound. Second, the Department probably should not have relied on the contingent valuation study to suggest the value that “society” places on rape prevention. First, the relevant study involved rape in general, not rape in prison. Second, and more important, we do not value life and health by asking citizens in general how much they would pay to provide the relevant goods. As we have seen, mortality risks are valued by asking people how much they would pay to prevent (say) a risk of 1 in 100,000 that they themselves face – not by asking citizens as a whole how much they would pay to prevent a death. The latter question is not easily intelligible, at least if it does not ask citizens about the full range of possible expenditures – involving not only prison rape, but rape in general, and assault, and theft, and homicide, and endangered species, and air pollution, and education, and homeland security, and antidiscrimination law, and much more. The “how much would you pay?” question, asked of “society,” quickly becomes unmanageable.

It is true that the direct beneficiary is not the only person who is helped by measures that protect life, health, and safety. If a regulation extends a life, friends and family are helped as well, and there is a good argument that the benefits to them should be counted in the calculus. Under current practice, they are not, and plausibly, that is a genuine gap.<sup>79</sup> But the question of benefits to “society” is exceedingly hard to answer through contingent valuation studies even if it is not irrelevant in principle. The numbers that emerge are unlikely to have much credibility.

The victim compensation measure is better. In the context of valuation of life, however, regulators do not ask about wrongful death actions or the like, but instead about willingness to pay (or to accept). That latter question typically produces significantly higher numbers, and it seems to be the right one.<sup>80</sup> For the prison rule, the parallel question would be: How much would people (prisoners) be willing to pay to reduce a (specified) risk of prison rape? But there is a real problem with this question, which is that any answer is unlikely to capture the welfare effects of being raped, not least because prisoners do not have a lot of money. The Department’s use of victim compensation was probably the best available option.

3. *Disability discrimination.* Suppose that a disability regulation has monetized costs of \$600 million and monetized benefits of \$400 million. Suppose that its principal function is to enable people who use wheelchairs to have easier access to bathrooms. Suppose finally that the agency – in this case, the Department of Justice – believes that one consequence of the rule will be to decrease stigma and humiliation, and to promote a

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<sup>78</sup> Id.

<sup>79</sup> See Eric A. Posner and Cass R. Sunstein, Dollars and Death, 72 U Chi L Rev 537 (2005).

<sup>80</sup> See W. Kip Viscusi, Fatal Tradeoffs (1989).

sense of inclusion, on the part of its beneficiaries.<sup>81</sup> That consequence is not easy to monetize, but it has a value, and a nontrivial one.

If human dignity is involved, how can the Department decide whether the \$200 million shortfall is justified? Suppose, hypothetically, that one million employees in the United States use wheelchairs, and that of these, 200,000 would be affected by the rule in question. If so, the breakeven question would be better it is worthwhile to spend \$1000 annually, per employee, to provide the requisite access. Unfortunately, the answer to that question is not self-evident. If the number were \$200, or \$10 million, things would be much easier.

In a case of this kind, the Department of Justice followed a strategy closely akin to its approach in the prison rape case. Lacking sufficient data, it engaged in breakeven analysis. Its calculation was that if either society or wheelchairs were willing to pay a very small amount per bathroom visit – for one part of the regulation, in the vicinity of 5 cents,<sup>82</sup> and for another part, in the vicinity of \$2.20 – the regulation would be worthwhile.<sup>83</sup> It asked what wheelchairs users would have to be willing to pay for the relevant benefits,<sup>84</sup> and what society would have to be willing to pay to provide them,<sup>85</sup> in order for the relevant requirements to have a net present value of zero. It concluded that the relevant amounts could be very small and nonetheless achieve the breakeven or threshold point.

This approach is also far from unreasonable, but here as well, some qualifications are appropriate. Note, first, that unlike in the case of prison rape, the Department did not have any evidence to produce a monetary valuation. Lacking that evidence, it had to proceed as it did. Note, second, that as we have seen, the proper measure is the

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<sup>81</sup> See note supra.

<sup>82</sup> “We estimate that people with the relevant disabilities will use a newly accessible single-user toilet room with an out-swinging door approximately 677 million times per year. Dividing the \$32.6 million annual cost by the 677 million annual uses, we conclude that for the costs and benefits to break even in this context, people with the relevant disabilities will have to value safety, independence, and the avoidance of stigma and humiliation at just under 5 cents per use.” *Id.* at 143.

<sup>83</sup> “We estimate that people with the relevant disabilities will use a newly accessible single-user toilet room with an in-swinging door approximately 8.7 million times per year. Dividing the \$19.14 million annual cost by the 8.7 million annual uses, we conclude that for the costs and benefits to break even in this context, people with the relevant disabilities will have to value safety, independence, and the avoidance of stigma and humiliation at approximately \$2.20 per use.” *Id.*

<sup>84</sup> “Under this methodology, for three of these four requirements, persons with disabilities need place a value of less than 1 cent on the benefits of avoided humiliation and/or improved safety (or any other non-monetized benefits) on each visit to facilities with elements affected by these requirements in order to make each requirements’ respective NPVs equal zero.” *Id.* at 146.

<sup>85</sup> “The second threshold estimate, by contrast, calculates the average monetary value each American (on a per capita basis) would need to place annually (over a fifteen year period) on the “existence” of improved accessibility for persons with disabilities (or the “insurance” of improved accessibility for their own potential use in the future) in order for the NPVs for each respective requirement to equal zero. Under this methodology, if Americans on average placed an “existence” value and/or “insurance” value of between 2 cents on the low end to 7 cents on the high end per requirement, then the NPVs for each of these requirements would be zero. Note that this later calculation assumes no added value of avoided humiliation, of increase safety and increased independence.” *Id.* at 146.

willingness to pay (or to accept) of the beneficiaries (and perhaps their friends and families), not of society in general. Third, the “per bathroom visit” measure is misleading, because that process of micro-disaggregation threatens to confuse the issue. Suppose that an employee uses a bathroom twice a day and works 300 days per year, so that the annual number of visits is 600. If the cost per visit is \$2, the total expenditure is \$1200, which is not exactly trivial.

There is a large problem here with micro-disaggregation of either benefits or costs. It is easy to frame an expensive regulation in terms that make it appear appealing – as in, for example, the idea that for a particular rule, one that reduces real risks, every American will have to be merely \$3 per day. Such a rule would cost over \$3 billion per year, and a rule of that kind would have adverse economic consequences whether or not it is ultimately justified. And if a rule confers merely \$3 in net benefits per American per day, it is produced over \$3 billion in net benefits per year, which means that it is a terrific bargain and indeed one of the best rules, in monetary terms, in the last decade. Micro-disaggregation can mask the benefits, the costs, and the net effects of rules.

Nonetheless, the Department’s analysis of the disability rule generally points in the right direction. It was correct to undertake breakeven analysis; it quantified where it could; and its ultimate conclusion was reasonable.

4. *Financial regulation.* Suppose that the cost of a new regulation, designed to reduce the risk of a financial meltdown, ranges between \$300 million and \$5 billion. Suppose that reasonable economists disagree on where the costs fall within that range, and that the agency is not far from sure about how to resolve the disagreement. Suppose that the agency seeks to estimate the cost of a meltdown, should it occur, but that the relevant range has a low end of \$150 billion and a high end (for some analysts) of \$3 trillion or (for other analysts) \$51 trillion.<sup>86</sup> Remarkably, projections of this kind are not unrealistic.<sup>87</sup> How shall the agency proceed?

If the statute requires the agency to act or to refrain from acting, the case is of course easy. Perhaps the analysis of costs and benefits is legally irrelevant. But suppose either that it is not or that as a matter of practice, the agency will produce that analysis even if its decision will be unaffected by it. What will the analysis look like? Is breakeven analysis feasible?

Here is one possibility. The high-end cost estimate is \$5 billion. If the rule reduces the risk of a meltdown by one percent, it survives breakeven analysis even if (1) we use the low-end cost estimate for a meltdown (\$150 billion) and (2) it reduces the risk of a meltdown by a small fraction of that figure (one in thirty). If the agency can say, plausibly, that the percentage contribution is in the requisite vicinity, its approach would appear to survive breakeven analysis.

But some people doubt that approaches of this sort can prove helpful, at least for

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<sup>86</sup> See Coates, *supra* note.

<sup>87</sup> *Id.*

some financial regulations.<sup>88</sup> In their view, some such regulations, at least at the present time, create intractable epistemic challenges. In the case just given, for example, the idea of a one in thirty reduction in the chance of a financial meltdown, for a single rule, seems both high and speculative -- which would mean that we have to engage other numbers at various points in the range, much complicating breakeven analysis. In cases of this kind, the range of possible costs can be very wide, and the range of possible benefits even wider, so much so that any effort to compare the two, or even to conduct breakeven analysis, might reflect a kind of pretense, in the form of a pretense to information that regulators simply lack.

This view is, in the end, a claim about how much knowledge is available. For that reason, it cannot be evaluated in the abstract. Everything depends on what regulators know, or can be expected to know. But we cannot rule out the possibility that in some cases, no form of breakeven analysis is realistically possible.

If so, of course, regulators should be candid about what they do not know, and should identify the assumptions on which their regulation might be justified. It is tempting, in such cases, to call for a presumption of liberty, and to say that regulators should not proceed, and cannot proceed, unless they are able to meet a burden of proof. But if the benefits of regulation could in fact be very large, that presumption seems arbitrary and potentially self-defeating. (In parallel cases, it is hardly irrational to purchase insurance.) Unfortunately, it is possible to imagine cases in which the best that regulators can do is to pick,<sup>89</sup> or even to opt.<sup>90</sup> But it is to be hoped that such cases are exceedingly rare, because regulation should not be a stab in the dark.

### Conclusion

The great advantage of quantitative cost-benefit analysis is that it focuses attention on the likely consequences of regulation, and thus helps to avoid the risk that judgments will be based on anecdotes, intuitions, dogmas, impressions, or the power of self-interested private groups.<sup>91</sup> At the same time, agencies must sometimes deal with values that cannot be quantified. In ordinary life, breakeven analysis is a common practice. In government, it is a reasonable way to handle the problem of nonquantifiability, above all when agencies can produce lower or upper bounds, which may show that on any plausible assumptions, a certain approach is or is not justified. Sometimes lower or upper bounds take the form of a point estimate; sometimes they represent expected values. Agencies should clarify their use of breakeven analysis by explicitly referring to the use of such bounds. It should be clear that if they are able to do so, the problem of nonquantifiability is only partial.

When lower or upper bounds are unavailable, it is far more challenging to use breakeven analysis. We have seen that agencies can enlist comparisons, above all by

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<sup>88</sup> Id.

<sup>89</sup> Ullmann-Margalit and Morgenbesser, *supra* note.

<sup>90</sup> Ullmann-Margalit, *supra* note.

<sup>91</sup> See Sunstein, Simpler, *supra* note.

reference to cases in which monetary values have previously been assigned. If, for example, the value of a statistical life is \$9 million, then injuries and illnesses that fall short of death cannot plausibly be valued in excess of \$9 million, and a wide variety of other harms must be assigned a lower value as well. When useful comparisons are not available, breakeven analysis may not be a great deal more than a conclusion or a hunch, but at least it can help to identify what information is missing and why some cases are genuinely hard. Breakeven analyses sometimes amounts to conditional justifications. Such justifications are far from useless, because they promote transparency and allow scrutiny of the assumptions on which they are based. They are also likely to encourage learning over time.

My emphasis has been on the role of nonquantifiable values in regulatory policies, but as I have noted, such values play a large role in many domains. Governments must consider them in making decisions about budgets, foreign policy, enforcement activity, and much more. Entrepreneurs must often act without precise information about how to quantify or monetize important variables. In ordinary life, people must make decisions about how to trade off an assortment of values, some of which defy quantification. In all of these contexts, some form of breakeven analysis is likely to be at work, and uses of lower and upper bounds are common, even if such uses are merely implicit. For these reasons, breakeven analysis is hardly limited to the regulatory context; it is an important aspect of practical reason in multiple areas of human life.

## Appendix A

### Selected Examples of Breakeven Analysis

Rule	Cost	Benefit
Terrorism-Coast Guard <sup>92</sup>	\$26.5 million annually at a 7 percent discount rate.	Rule would be cost-justified if it prevents one terrorist attack with consequence equal to the average every 130.9 years. <sup>93</sup>
Terrorism-Freight Trains <sup>94</sup>	Not yet calculated	Not yet calculated. <sup>95</sup>
Terrorism-Aviation <sup>96</sup>	\$285 million annually at a 7 percent discount rate.	Not yet calculated <sup>97</sup>
Prison Rape <sup>98</sup>	\$8.2 million per year annualized at a 7 percent discount rate.	Rule would be cost-justified if it reduces the annual number of sexual abuse incidents by 55. <sup>99</sup>
Terrorism-Highway Rail Crossings <sup>100</sup>	\$1.52 million over 20 years at a 7 percent discount rate.	Rule would be cost-justified if there is a decrease of 0.015% of crossing accidents over twenty years. <sup>101</sup>

<sup>92</sup> Transportation Worker Identification Credential (TWIC)—Reader Requirements; 78 FR 17782 (2013).

<sup>93</sup> "If implementing this regulation would lower the likelihood of a successful terrorist attack by more than 1 percent each year, then this would be a socially efficient use of resources. This proposed rule is estimated to cost approximately \$ 26.5 million annually. This proposed rule would be cost effective if it prevented one terrorist attack with consequence equal to the average every 130.9 years (\$ 3,468.7/\$ 26.5)." (pg. 17822).

<sup>94</sup> Introduction to the Unified Agenda of Federal Regulatory and Deregulatory Actions; 78 FR 1317 (2013).

<sup>95</sup> "TSA has not quantified benefits. TSA, however, expects that the primary benefit of the Security Training NPRM will be the enhancement of the United States surface transportation security by reducing the vulnerability of freight railroad systems, public transportation agencies, passenger railroads, and over-the-road bus entities to terrorist activity through the training of security-sensitive employees." (pg. 1400).

<sup>96</sup> Introduction to the Unified Agenda of Federal Regulatory and Deregulatory Actions; 78 FR 1317 (2013).

<sup>97</sup> "TSA has not quantified benefits. However, a major line of defense against an aviation-related terrorist act is the prevention of explosives, weapons, and/or incendiary devices from getting on board a plane... With this rule, attention is given to aircraft that are located at repair stations and to aircraft parts that are at repair stations to reduce the likelihood of an attack against aviation and the country." (pg. 1403).

<sup>98</sup> Standards To Prevent, Detect, and Respond to Sexual Abuse and Assault in Confinement Facilities; 77 FR 75300 (2012).

<sup>99</sup> "DOJ estimates extrapolate from the existing economic and criminological literature regarding rape in the community. The RIA concludes that when all facilities and costs are phased into the rulemaking, the breakeven point would be reached if the standards reduced the annual number of incidents of sexual abuse by 55 from the estimated benchmark levels." (pg. 75302).

<sup>100</sup> National Highway-Rail Crossing Inventory Reporting Requirements; 77 FR 64077 (2012).

<sup>101</sup> The main benefit derived from the rule would be improved crossing inventory data. This more precise information would better enable FRA, railroads, and any other entity to accurately analyze pertinent data, detect trends, and if needed, initiate crossing-related safety initiatives. In this break-even analysis, FRA determined that if there were a decrease of 0.015 percent of crossing accidents over the twenty-year period the costs associated with the rule would break-even." (pg. 64086).



Emergency Preparedness-Trains <sup>102</sup>	Industry cost: \$ 1.5 million with a over 10 years with a 7 percent discount rate.	Rule would be cost-justified if 3.84 injuries are prevented from increasing in severity. <sup>103</sup>
Prison Rape-PREA <sup>104</sup>	\$ 468.5 million per year when annualized at a 7 percent discount rate.	Rule would be cost-justified if the annual number of prison rape victims is reduced by 1,671. <sup>105</sup>
Fire Suppression-Coast Guard <sup>106</sup>	\$2.3 million over 10 years at a 7 percent discount rate.	Rule would be cost-justified if it prevents one fatality every 4-5 years. <sup>107</sup>
Rail Employee Safety-Employee Training <sup>108</sup>	\$64. 1 million over 20 years, discounted to present dollars at a 7 percent discount rate	Rule would be cost-justified if it results in a 7% reduction in human factors-caused accidents. <sup>109</sup>

<sup>102</sup> Passenger Train Emergency Preparedness; 77 FR 38248 (2012).

<sup>103</sup> The proposed regulation would generate safety benefits by preventing injuries in passenger rail accidents from becoming more severe...A break-even analysis quantifies what minimum safety benefits are necessary for the proposed rule to be cost-effective, considering the estimated quantified costs. For this proposed rule, this analysis estimates that the break-even point is met when 3.84 injuries are prevented from increasing in severity from AIS 1 to AIS 2." (pg. 38258).

<sup>104</sup> National Standards To Prevent, Detect, and Respond to Prison Rape; 77 FR 37106 (2012).

<sup>105</sup> "Executive Order 13563 states that agencies "may consider (and discuss qualitatively) values that are difficult or impossible to quantify, including equity, human dignity, fairness, and distributive impacts." Each of these values is relevant here, including human dignity, which is offended by acts of sexual violence. While recognizing the limits of monetary measures and the difficulty of translation into dollar equivalents, the RIA extrapolates from the existing economic and criminological literature regarding rape in the community. On the basis of such extrapolations, it finds that the monetizable benefit to an adult of avoiding the highest category of prison sexual misconduct (nonconsensual sexual acts involving injury or force, or no injury or force but high incidence) is worth \$ 310,000 to \$ 480,000 per victim; for juveniles, who typically experience significantly greater injury from sexual abuse than do adults, the corresponding category is assessed as worth \$ 675,000 per victim...The RIA concludes that the break-even point would be reached if the standards reduced the annual number of victims of prison rape by 1,671 from the baseline levels, which is less than 1 percent of the total number of victims in prisons, jails, and juvenile facilities." (pg. 37111).

<sup>106</sup> Carbon Dioxide Fire Suppression Systems on Commercial Vessels; 77 FR 33860 (2012).

<sup>107</sup> "The breakeven analysis of the NPRM (which included all new and existing fire suppression systems on certain classes of commercial vessels) found that the rule would need to prevent 0.22 fatalities per year to break even, or about one fatality every 4-5 years... This analysis did not include the value of potential non-fatal injuries and secondary impacts. As this rulemaking seeks to reduce risk to the crew on vessels with CO[2] fire suppression systems, the potential value of the avoided damages at risk is quite large in comparison to the relatively minor costs of the proposed safety measures in the NPRM." (pg. 33865).

<sup>108</sup> Training, Qualification, and Oversight for Safety-Related Railroad Employees; 77 FR 6412 (2012).

<sup>109</sup> "FRA has performed a breakeven analysis of the proposed rule, estimating the reduction in human factors-caused accidents that would be required in order for the benefits of the proposed rule to at least offset the costs... Reductions in human factors-caused accidents will result in fatalities avoided, injuries avoided, and property damage avoided." (pg. 6413).

Rail-Emergency Systems <sup>110</sup>	\$13.3 million over 20 years discounted to present dollars at a 7 percent discount rate.	Not explicitly stated. <sup>111</sup>
Commercial Motor Vehicles-Restrictions on Cell Phone Use <sup>112</sup>	\$12.1 million per year discounted at 7 percent.	Rule would be cost-justified if it eliminates two fatalities per year. <sup>113</sup>
Airlines-Cargo Screening This rule amends two provisions of the Air Cargo Screening Interim Final Rule (IFR) issued on September 16, 2009, and responds to public comments on the IFR. <sup>114</sup>	\$178.1 million annualized and discounted at 7 percent.	Not explicitly stated. <sup>115</sup>
Terrorism-Ammonium Sale Restrictions <sup>116</sup>	\$300 million to \$1.041 billion over 10 years at a 7 percent discount rate.	Rule would be cost-justified if it prevents one terrorist attack every 14.1 years <sup>117</sup>

<sup>110</sup> Passenger Train Emergency Systems II; 77 FR 154 (2012).

<sup>111</sup> "The proposed rulemaking is expected to improve railroad safety by promoting the safe evacuation of passengers and crewmembers in the event of an emergency. The primary benefits include a heightened safety environment in egress from a passenger train after an accident. This corresponds to a reduction of casualties and fatalities in the aftermath of an accident or other emergency situations. FRA believes the value of the anticipated safety benefits would justify the cost of implementing the proposed rule." (pg. 172).

<sup>112</sup> Drivers of CMVs: Restricting the Use of Cellular Phones; 76 FR 75470 (2011).

<sup>113</sup> "Threshold analysis for this rule shows that restricting hand-held mobile telephones would lead to an estimated one-year cost of \$ 12.1 million. Current guidance from DOT's Office of the Secretary places the value of a statistical life at \$ 6.0 million. Consequently, this rule will need to eliminate any combination of crash types equivalent to two fatalities per year in order for the benefits of this rule to equal the costs....Because FMCSA and PHMSA are addressing two of the risky activities--reaching for and dialing on a hand-held mobile telephone--cited in the Olson, et al. (2009) study, restricting the use (including holding) of hand-held mobile telephones is expected to prevent more than two fatalities and the benefits to justify the cost." (pg. 75483).

<sup>114</sup> Air Cargo Screening; 76 FR 51848 (2011).

<sup>115</sup> "The CCSP allows for more standardized governance in cargo screening and provides fourfold benefits in terms of increased security of commercial passenger aviation...The estimate of the economic impacts of the [terrorist] attack scenarios used in these break-even analyses is limited to direct costs only (value of casualties and loss of aircraft). This analysis does not consider any indirect or macroeconomic consequences these terrorist attacks might cause." (pg. 51865).

<sup>116</sup> Ammonium Nitrate Security Program; 76 FR 46908 (2011).

<sup>117</sup> "In this break-even analysis, DHS compared the annualized costs of the proposed rule to the expected benefits of preventing an ammonium nitrate based terrorist attack, such as the attack on the Murrah federal building. In order to estimate the impact of this attack in dollar terms, DHS must assume a value per statistical life (VSL)... The Department is assuming a VSL of \$ 6 million, which is equivalent to saying someone is willing to pay \$ 6 to receive a one-in-a-million reduction in the risk of death or \$ 60 to receive a one-in-a-one-hundred-thousand reduction in the risk of death. Applying the \$ 6 million VSL to the 168 deaths from the Murrah attack plus the cost of other expenditures that are directly related to the attack (such as the cost of replacing the Murrah Building), DHS estimates the cost to society of the Murrah attack to be approximately of \$ 1.35 billion (2010 dollars). As this proposed rule is expected to cost society approximately \$ 95.5 million annually, this proposed rule would be cost effective if it prevented one terrorist attack similar to the Murrah building attack every 14.1 years." (pg. 46936).

Nutrition Labeling-Restaurants <sup>118</sup>	\$34.9 million to \$ 130.1 million annualized at a 7 percent discount rate.	Rule would be cost-justified if 0.06 percent of the adult obese population reduces caloric intake by 100 calories per week. <sup>119</sup>
Nutrition Labeling-Vending Machines <sup>120</sup>	\$ 24.5 million annualized at a 7 percent discount rate.	Rule would be cost-justified if 0.02 percent of the adult obese population reduces caloric intake by 100 calories per week. <sup>121</sup>
Hazardous Materials Risk Assessment <sup>122</sup>	\$ 3.5 million per year.	Rule would be cost-justified if it reduces risk of hazardous materials incidents by 40%. <sup>123</sup>

<sup>118</sup> Food Labeling; Nutrition Labeling of Standard Menu Items in Restaurants and Similar Retail Food Establishments; 76 FR 19192 (2011).

<sup>119</sup> "FDA has not estimated the actual benefits associated with proposed requirements. Food choice and consumption decisions are complex, and FDA is unaware of any comprehensive data allowing accurate predictions of the effect of the proposed requirements on consumer choice and establishment menus. Therefore, FDA has constructed a plausible individual effect of the proposed rule, and has conducted a break-even analysis in order to determine the proportion of the U.S. obese adult population that would need to attain this minimal response in order for the proposed requirement to yield a positive net benefit. Using a 100 calorie per week reduction in intake as the benchmark effect, FDA estimates that at least 0.06 percent of the adult obese population would need to reach at least this benchmark in order for the rule to break even on the primary, or mean annualized cost." (pg. 19221).

<sup>120</sup> Food Labeling; Calorie Labeling of Articles of Food in Vending Machines; 76 FR 19238 (2011).

<sup>121</sup> "FDA has not estimated the actual benefits associated with proposed requirements. Food choice and consumption decisions are complex and FDA is unaware of any comprehensive data allowing accurate predictions of the effect of the proposed requirements on consumer choice and vended foods. Therefore, FDA has constructed a plausible individual effect of the proposed rule, and has conducted a break-even analysis in order to determine the proportion of the U.S. obese adult population that would need to attain this minimal response in order for the proposed requirement to yield a positive net benefit. Using a 100 calorie per week reduction in intake as the benchmark effect, FDA estimates that at least 0.02 percent of the adult obese population would need to reach this benchmark in order for the rule to break even on the initial total cost." (pg. 19246).

<sup>122</sup> Hazardous Materials: Cargo Tank Motor Vehicle Loading and Unloading Operations; 76 FR 13313

<sup>123</sup> "Based on the assumptions and estimates described above, the breakeven point for this rule--that is, the point at which benefits and costs are approximately equal--occurs at an incident-reduction effectiveness level of approximately 40 percent for affected firms. For this analysis, based on available literature and expert judgment, we believe that an effectiveness level of 40 percent is a reasonable assumption for this group of safety interventions, particularly since the subject incidents have been defined narrowly as those in which (largely preventable) human error occurs during the loading or unloading phase, such as overfilling, over-pressurizing, or loading incompatible materials" (pg. 13323).

Food Safety Inspection-Catfish <sup>124</sup>	Present value \$74.8 million over 10 years using a 7-percent discount rate.	Rule would be cost-justified if 790 salmonellosis illnesses are prevented. <sup>125</sup>
Food Shipping-Farm Bill <sup>126</sup>	Not yet estimated.	Not yet estimated. <sup>127</sup>
Expanded Field of View for Vehicles <sup>128</sup>	\$ 19.7 million based on a 7 percent discount rate	Rule would be cost-justified if nonquantified benefits to each vehicle are at least \$65. <sup>129</sup>
Commercial Motor Vehicles-Rule Disqualifying Those with Traffic Offenses <sup>130</sup>	\$ 3.8 million annually	Rule would be cost-justified if it eliminates one fatality every year. <sup>131</sup>

<sup>124</sup> Mandatory Inspection of Catfish and Catfish Products; 76 FR 10434 (2011).

<sup>125</sup> "Epidemiological evidence suggests that salmonellosis leads to both acute and chronic illnesses. The acute illness that accompanies salmonellosis generally causes gastrointestinal symptoms that can lead to lost productivity and medical expenses. In rare instances, salmonellosis may result in acute or chronic arthritis. Arthritis is characterized by limited mobility, pain and suffering, productivity losses, and medical expenditures. Finally, salmonellosis can result in death. The risk of death appears to be higher in the elderly, children, and people with compromised immune systems. FSIS has estimated the costs for each of these severity levels. If roughly 790 illnesses were averted, the benefits of the proposed rule would equal the additional costs." (pg. 10456).

<sup>126</sup> Introduction To The Unified Agenda Of Federal Regulatory And Deregulatory Actions; 75 FR 79459 (2010).

<sup>127</sup> "The benefit of this rule is the improvement of CBP's risk assessment and targeting capabilities, while at the same time, enabling CBP to facilitate the prompt release of legitimate cargo following its arrival in the United States. The information will assist CBP in increasing the security of the global trading system, and thereby reducing the threat to the United States and the world economy." (no page).

<sup>128</sup> Federal Motor Vehicle Safety Standard, Rearview Mirrors; Federal Motor Vehicle Safety Standard, Low-Speed Vehicles Phase-In Reporting Requirements; 75 FR 76186 (2010).

<sup>129</sup> "The proposed solution is the most comprehensive and effective, currently available solution to mitigate backover crashes, fatalities, and injuries. As we discussed above, the quantitative analysis does not offer a complete accounting. We have noted that well over 40 percent of the victims of backover crashes are very young children (under the age of five), with nearly their entire life ahead of them. Executive Order 12866 also refers explicitly to considerations of equity. ("(I)n choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including equity), and there are strong reasons, grounded in those considerations, to prevent the deaths at issue here. In addition, this regulation will, in many cases, reduce a qualitatively distinct risk, which is that of directly causing the death or injury of one's own child. Drivers will also benefit from increased rear visibility in a variety of ways, including increased ease and convenience with respect to parking. While these benefits cannot be monetized, they could be significant. A breakeven analysis suggests that if the nonquantified benefits amount \$ 65 to \$ 79 per vehicle, the benefits would justify the costs." (pg. 76238).

<sup>130</sup> Limiting the Use of Wireless Communication Devices; 75 FR 59118 (2010).

<sup>131</sup> "Current guidance from the Office of the Secretary of Transportation (OST) places the value of a statistical life at \$ 6.0 million. Consequently, the texting restriction would have to eliminate at most one fatality every year in order for the benefits of this rule to at least equal the costs. Given the unchecked expansion of texting, FMCSA believes the rule will save lives and prevent a substantial number of crashes. Therefore, the rule is justified based on the safety benefits." (pg. 59132).

Nutrition Labeling-Meat and Poultry <sup>132</sup>	Net present values of \$316.99 million over 20 years using a 7 percent discount rate..	Rule would be cost-justified if 0.53 lives are saved annually. <sup>133</sup>
Airline Security-Security of Aircraft Repair Stations <sup>134</sup>	\$ 45,200 for all respondents annualized over the next three years.	Rule would be cost-justified if one moderate terrorist attack is prevented every 92 years. <sup>135</sup>
Airlines-Baggage Screening <sup>136</sup>	Rule costs of \$ 1.9 billion discounted by 7 percent. Industry costs for delayed shipment of cargo estimated at \$ 203.1 million at a seven percent discount rate.	Rule would be cost-justified if it prevents one attack every 2.6 years. <sup>137</sup>
Airline Crew Standards <sup>138</sup>	\$ 7.7 million over 20 years using a 7% discount rate.	Rule would be cost-justified if it prevents at least 10 serious injuries over the period of analysis. <sup>139</sup>

<sup>132</sup> Nutrition Labeling of Single-Ingredient Products and Ground or Chopped Meat and Poultry Products; 74 FR 67736 (2009).

<sup>133</sup> "The average reduction in risk for the benefits of POP nutrition information for major cuts of single ingredient, raw products to equal their cost is 0.53 lives saved annually  $((2.88+2.93)/2)/5.5$  assuming a value of life of \$ 5.5 million (Table 25). The reduction in risk for the benefits of on-package nutrition labels for ground or chopped products to equal their cost is about ten times greater (5.34 lives saved annually). The estimated total reduction in risk in order for the benefits of these combined measures to exceed costs is 5.87 lives saved annually or about one-ninth  $(5.87/50.1)$  of the estimated 50.1 lives saved annually under the composite scenario, using a value of life saved of \$ 5.5 million." (pg. 67785).

<sup>134</sup> Aircraft Repair Station Security; 74 FR 59874 (2009).

<sup>135</sup> "A major line of defense against an aviation-related terrorist act is the prevention of explosives, weapons, and/or incendiary devices from getting on board a plane... With this rule, attention is given to aircraft that are located at repair stations, and to aircraft parts that are at repair stations, themselves to reduce the likelihood of an attack against aviation and the country. Since repair station personnel have direct access to all parts of an aircraft, the potential exists for a terrorist to seek to commandeer or compromise an aircraft when the aircraft is at one of these facilities." (pg. 59884).

<sup>136</sup> Air Cargo Screening; 74 FR 47672 (2009).

<sup>137</sup> "TSA has assessed the benefits of this rule via a break-even analysis of the cost of the reduction in risk with the dollar amount of the benefit from the rule. The break-even analysis illustrates the tradeoff between program costs and program benefits. For purposes of the analysis, TSA evaluated four scenarios in which an explosive device was placed in the aircraft's cargo hold via air cargo and detonated, destroying the airplane and all passengers and crew on board. For each scenario, TSA derived a total monetary cost of consequence from an estimated value of the statistical human lives lost and the value of the plane (including cargo) destroyed. TSA obtained a value of the monetary cost of an attack under a certain probability (the value of which equals the total estimated monetary cost of the attack multiplied by the probability of an attack of that nature over a year-long time period) and compared it to the undiscounted, annualized cost of the CCSP to estimate how often an attack of that nature would need to be averted for the expected benefits to equal costs." (pg. 47693).

<sup>138</sup> Flightcrew Alerting; 74 FR 32810 (2009).

<sup>139</sup> "By examining the historical data, we have shown that over the past twenty years, there were both non-fatal events and fatal events, which might have been prevented with the requirements contained in this NPRM. The potential severity of an event is demonstrated in the DC 9-82 accident on August 16, 1987, that occurred shortly after takeoff from Detroit Metropolitan Airport, which resulted in 154 deaths. The National Transportation Safety Board (NTSB) determined that one contributing factor was the airplane takeoff warning system, which failed to warn the flightcrew that the airplane was improperly configured for takeoff. This finding led to the current proposed rulemaking." (pg. 32815).

Medication Labeling-Over the Counter Drugs <sup>140</sup>	\$ 71.0 million at 7 percent discount rate.	Rule would be cost-justified if it prevents at least 2 deaths per year. <sup>141</sup>
Medication Labeling-Over the Counter Drugs <sup>142</sup>	One-time compliance costs of \$ 32 million in the first year.	Rule would be cost-justified if it prevents 1 death per year for 10 years or 476 hospitalizations per year for 10 years. <sup>143</sup>

<sup>140</sup> Organ-Specific Warnings; Internal Analgesic, Antipyretic, and Antirheumatic Drug Products for Over-the-Counter Human Use; Final Monograph; Corrections; 74 FR 31177 (2009).

<sup>141</sup> "Because of the uncertainty in these estimates, we estimated an annual average number of adverse events that would need to be avoided over a 10 year period to reach a break-even point (i.e., the present value of the cost of compliance divided by the present value of the monetary value of avoiding an adverse event each year for 10 years). The following calculations are based on 2001 dollars, which will not affect the estimated break-even values to be calculated. For benefits to equal costs, this final rule would need to prevent about 2 deaths each year over 10 years [1.9 deaths (\$ 71.0 million/\$ 37.6 million at a 7 percent discount rate) and 1.7 deaths (\$ 72.9 million/\$ 43.9 million at a 3 percent discount rate)]. This estimate of deaths avoided is based on a value of \$ 5 million per statistical life. Alternatively, if no deaths are avoided, the final rule would need to prevent about 1,058 hospitalizations each year over the 10-year period at the 7 percent discount rate (\$ 71.0 million/\$ 67,156), and 928 hospitalizations a year at the 3 percent discount rate (\$ 72.9 million/\$ 78,513). This estimate of hospitalizations avoided is based on the lowest monetized value of a poisoning episode requiring hospitalization: \$ 8,936 per episode over 10 years at a 7 percent discount rate. Although we lack evidence to predict with certainty a specific level of reduction in adverse events, if we assume only a 2 percent reduction in the illnesses and deaths analyzed, the benefits of this final rule [\*31180] outweigh the costs. We find that this final rule will enhance public health and promote the safer use of OTC acetaminophen and NSAID drug products." (pg. 31178)

<sup>142</sup> Organ-Specific Warnings; Internal Analgesic, Antipyretic, and Antirheumatic Drug Products for Over-the-Counter Human Use; Final Monograph; 74 FR 19385 (2009).

<sup>143</sup> "This final rule would need to prevent about 1 death each year over 10 years... Alternatively, if no deaths are avoided, the final rule would need to prevent about 476 hospitalizations (\$ 32 million/\$ 67,000) each year over the 10-year period... Although we lack evidence to predict with certainty a specific level of reduction in adverse events, if we assume only a 1-percent reduction in the illnesses and deaths analyzed, the benefits of this final rule outweigh the costs." (pg. 19405).

## Appendix B

### Recent Values for Mortality and Morbidity<sup>144</sup>

Health Endpoint	Central Estimate of Value Per Statistical Life	
	1990 Income Level	2020 Income Level
<b>Premature Mortality</b> (Value of a Statistical Life)	\$8,000,000	\$9,600,000
<b>Nonfatal Myocardial Infraction</b> (heart attack)		
<i>3% discount rate</i>		
Age 0-24	\$87,000	\$87,000
Age 25-44	\$110,000	\$110,000
Age 45-54	\$120,000	\$120,000
Age 55-64	\$200,000	\$200,000
Age 65 and over	\$98,000	\$98,000
<i>7% discount rate</i>		
Age 0-24	\$97,000	\$97,000
Age 25-44	\$110,000	\$110,000
Age 45-54	\$110,000	\$110,000
Age 55-64	\$190,000	\$190,000
Age 65 and over	\$97,000	\$97,000
<b>Hospital Admissions</b>	2000 Income Level	2020 Income Level
Chronic Lung Disease (18-64)	\$21,000	\$21,000
Asthma Admissions (0-64)	\$21,000	\$21,000
All Cardiovascular		
Age 18-64	\$42,000	\$42,000
Age 65-99	\$41,000	\$41,000
All Respiratory (Age 65+)	\$36,000	\$36,000
Emergency Department Visits for Asthma	\$430	\$430
<b>Respiratory Ailments Not Requiring Hospitalization</b>	2000 Income Level	2020 Income Level
Upper Respiratory Symptoms		\$33
	\$31	
Lower Respiratory Symptoms		\$21
	\$20	
Asthma Exacerbations		\$58

<sup>144</sup> See Table 5-9 of the Final Regulatory Impact Analysis for Particulate Matter, available at <http://www.epa.gov/ttn/ecas/regdata/RIAs/finalria.pdf> (2013).

## Appendix C

### Breakeven Analysis of Department of Justice<sup>145</sup>

#### 6.6 Threshold Analysis

Given that the range of possible NPV values for the entire Final Rules are unlikely to be less than zero (see Section 6), the foregoing discussion of unquantified benefits has greatest potential impact on particular requirements with negative NPVs. If requirements and their impacts can be considered separately, those with negative monetized NPVs will warrant closer evaluation. For these requirements, the actual total overall value to society includes the non-monetized benefits discussed above, and the true NPV for each is some value greater than the figure presented here.

To gain additional perspective on the full range of benefits, this RIA includes several analyses in a Threshold Analysis. In cases where quantitatively measured costs exceed the quantitatively measured benefits by \$100 million or more over the life of the rule, the “*threshold value*” is the value that society would need to assign to the unquantified benefits to “balance the ledger” (to balance benefits with costs). This threshold analysis is applied in relation to the value of stigmatic harm, safety and insurance value for several requirements, and as well as an annualized estimate over 54 years (after which those last facilities built before the expected new rule with safe harbor would likely be complete replaced) for the two requirements with the largest negative NPVs (Water closet clearance in single-user toilet rooms - out swinging door and Water closet clearance in single-user toilet rooms - in swinging door).

The requirements relating the water closet clearances are among the most costly (in monetary terms) of the new provisions. Although the *monetized* costs of these requirements substantially exceed the *monetized* benefits, the benefits that have not been monetized (avoiding stigma and humiliation, protecting safety, and enhancing independence) are expected to be quite high.

The added clearance ensures that wheelchair users can effect a side transfer, which may often obviate the need for obtaining the assistance of another person to engage in what is, for most people, among the most private of activities.

We estimate that the costs of the requirement as applied to out-swinging doors will exceed the monetized benefits by \$454 million, which when annualized over 54 years

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<sup>145</sup> See DEPARTMENT OF JUSTICE: DISABILITY RIGHTS SECTION OF THE CIVIL RIGHTS DIVISION, FINAL REGULATORY IMPACT ANALYSIS OF THE FINAL REVISED REGULATIONS IMPLEMENTING TITLES II AND III OF THE ADA, INCLUDING REVISED ADA STANDARDS FOR ACCESSIBLE DESIGN 142-146, available at [http://www.ada.gov/regs2010/RIA\\_2010regs/DOJ%20ADA%20Final%20RIA.pdf](http://www.ada.gov/regs2010/RIA_2010regs/DOJ%20ADA%20Final%20RIA.pdf).



equals a net cost of approximately \$32.6 million a year. We estimate that people with the relevant disabilities will use a newly accessible single-user toilet room with an out-swinging door approximately 677 million times per year. Dividing the \$32.6 million annual cost by the 677 million annual uses, we conclude that for the costs and benefits to break even in this context, people with the relevant disabilities will have to value safety, independence, and the avoidance of stigma and humiliation at just under 5 cents per use.

There are substantially fewer single-user toilet rooms with in-swinging doors, and substantially fewer people with disabilities will benefit from making those rooms accessible. And the alterations costs to make a single-user toilet room with an in-swinging door accessible are substantially higher (because of the space taken up by the door) than the equivalent costs of making a room with an out-swinging door accessible. Thus, we calculate that the costs of applying the toilet room accessibility standard to rooms with in-swinging doors will exceed the monetized benefits of doing so by \$266.3 million over the life of the regulation, or approximately \$19.14 million per year when annualized over 54 years.

We estimate that people with the relevant disabilities will use a newly accessible single-user toilet room with an in-swinging door approximately 8.7 million times per year. Dividing the \$19.14 million annual cost by the 8.7 million annual uses, we conclude that for the costs and benefits to break even in this context, people with the relevant disabilities will have to value safety, independence, and the avoidance of stigma and humiliation at approximately \$2.20 per use.

### **6.6.1 Value of Stigmatic Harm**

The threshold analysis presented here is applied using an estimate on the value of stigmatic harm, safety benefits (for some requirements) and insurance value. In other words, the analysis seeks to estimate by how much society would need to value reduced stigmatic harm, fewer injuries and the option value of using the increased accessibility in the future in order to balance benefits with costs. For purposes of the threshold value, the value of eliminating stigmatic harm may be inferred from studies and analysis of behavior associated with transit use. Similar to values that are applied in the main cost-benefit analysis related to the quality of the trip, additional insight may be gained from studies that evaluated the likelihood of using segregated vehicles compared to integrated vehicles. For instance, by observing the proportion of persons with disabilities who elect to use adapted transit when dial-a-ride is available at equal or lesser fare and better time costs, their preference for transit can be attributed to its public availability. In other words, the proportion of people that choose to take integrated transportation service as opposed to segregated service suggests an interest in avoiding the stigma of being disabled.

Studies collect information about the proportion of persons with disabilities who use segregated dial-a-ride service when regular service is available. One study found that approximately 80% of persons with disabilities elected to use dial-a-ride; in other words, while their motivations are certainly not definitively known, 20% of users may have

chosen regular service to avoid stigmatic harm, or at least part of their rationale could have included this aspect of value.

This proportion can be converted to a weight on the value of time (similar to quality of time adjustments related to access time) for use in the threshold analysis. The equivalent weight would be computed from the proportion's inverse value, or  $[1/(\text{proportion of dial-a-ride users})]$ . While this conversion formula may be overly simplistic, the rationale is consistent with theory. For example, when the proportion of dial-a-ride users is 100%, there is no value of stigmatic harm. At the opposite extreme, if no persons with disabilities choose dial-a-ride, the potential for significant stigmatic harm would likely be part of the reason for this choice. For our example of a user population of 80%, the weight on the value of time to avoid stigmatic harm is 1.25, or 25% above the normal value of time.

Adding an additional factor to the value of time saved by improved accessibility that accounts for the avoided stigmatic harm will increase benefits for all requirements that are more stringent, but will also increase the disbenefits that arise from relaxed requirements. Since more stringent requirements outweigh less stringent requirements in this rule, the overall impact of incorporating the avoidance of stigmatic harm would be to increase the overall net benefits of the rule.

Based on the above, an estimated premium of 0.25 for avoiding stigmatic harm can be applied to the estimation (this premium was not included in the primary analysis partly because the research behind this estimation is not as extensive as the research behind estimates of premiums for travel comfort). The effect of this premium on the negative NPVs is best calculated on the IBC-specific NPV (in which costs and benefits were adjusted according to a state-by-state review of whether the States/counties had adopted that specific requirement out of the IBC), where available. Thus, for the four more stringent requirements which have individual IBC-specific NPVs that are negative by at least \$100 million, incorporating the avoidance for stigmatic harm into the benefits calculations shrinks the State-IBC Specific NPVs from \$1.0 B to \$0.8 B.

**Table 18: Impact of 0.25 Premiums on Value of Time for Avoiding Stigmatic Harm for Select Requirements (million \$)  
(Under Safe Harbor, 50% Readily Achievable Barrier Removal, 1991 Standards for Baseline, 7% Discount Rate)**

<b>Number</b>	<b>Requirement</b>	<b>NPV Baseline of 1991 Standards, Safe Harbor, 50% Readily Achievable, 7% discount rate</b>	<b>% of All Facilities Covered by Individual State Adoption of IBV</b>	<b>NPV Using State-Specific IBC for Baseline</b>	<b>NPV Using State-Specific IBC for Baseline and Including .25 Premium on Time for Avoided Stigmatic Harm</b>
16	Alterations to Existing Elevators	-\$339.0	70%	-\$102	-\$102
28	Water Closet Clearance in Single-User Toilet Rooms – Out-Swinging Doors	-\$898.4	46%	-\$454	-\$316
32	Water Closet Clearance in Single-User Toilet Rooms – In Swinging Doors	-\$974.7	72%	-\$266	-\$271
37	Side Reach	-\$555.0	72%	-\$153	-\$105
<b>Total</b>				<b>-\$975</b>	<b>-\$794</b>

A “threshold premium” on the value of time can be calculated for each of these individual requirements. This ‘threshold premium’ is the premium required on the value of time in order to shift the NPV for that individual requirement to zero. In other words, this premium represents how many more people would value avoiding the stigma or embarrassment that the new addresses. For two of these requirements – Water Closet Clearance in Single-User Toilet Rooms With Out-Swinging Door (Req. # 28) and Side Reach (Req. # 37) the threshold premium would only need to be 1.4 and 1.5 respectively for their NPVs to be equal to zero using a requirement-specific alternate IBC/ANSI baseline. To put these stigmatic threshold premiums into perspective, the 1.4 threshold premium for the water closet clearance requirement for single- user toilet rooms with out-swinging doors means that the negative NPV for this requirement would be reduced to zero if a person with a disability who needed to use the restroom at a shopping mall valued avoiding stigmatic harm while accessing the mall’s single-user toilet room by at little as 16 cents.

**Table 19: Impact of 0.25 Premiums on Value of Time for Avoiding Stigmatic Harm for Select Requirements (million \$)  
(Under Safe Harbor, 50% Readily Achievable Barrier Removal, 1991 Standards for**

**Baseline, 7% Discount Rate)**

<b>Number</b>	<b>Requirement</b>	<b>Expected NPV in Main Analysis (million \$)</b>	<b>State-IBC Specific NPC (million \$)</b>	<b>Avoided Stigmatic Harm Threshold Premium*</b>	<b>NPV at Threshold</b>
16	Alterations to Existing Elevators	-\$339.0	-\$102	220.7	\$0.0
28	Water Closet Clearance in Single-User Toilet Rooms – Out-Swinging Doors	-\$898.4	-\$454	1.4	\$0.0
32	Water Closet Clearance in Single-User Toilet Rooms – In Swinging Doors	-\$974.7	-\$266	46.9	\$0.0
37	Side Reach	-\$555.0	-\$153	1.5	\$0.0

\*Premium for stigmatic harm (applied to all requirements) which would result in an NPV of zero for the requirements.

As noted above, promulgation of the final rules would also likely generate many other substantial unquantified benefits aside from avoidance of stigmatic harm. For persons with disabilities, these additional benefits might well include avoided humiliation (*i.e.*, embarrassment which goes beyond the general desire to avoid “standing out” as a person with a disability) and strengthened safety measures. Persons without disabilities may also experience benefits from believing that the final will improve access/decrease discrimination encountered by persons with disabilities, or by placing value on the “insurance” of improved accessibility for their potential use in the future if needed.

Another threshold analysis contains two calculations to explore the potential value significance of these additional – and in relation to the same four requirements. The first (Scenario A) estimates the average monetary value that persons with the types of disabilities expected to benefit from the improved access generated by each of these requirement must place per facility visit on avoiding humiliation and/or increased safety in order for the NPV for each respective requirement to equal zero under a requirement-

specific alternate IBC/ANSI baseline. (These figures are calculated by dividing the state-specific NPV by the number of visit to facilities with these elements by persons with the targeted disability over a fifteen year period, after which new rules are expected). Under this methodology, for three of these four requirements, persons with disabilities need place a value of less than 1 cent on the benefits of avoided humiliation and/or improved safety (or any other non-monetized benefits) on each visit to facilities with elements affected by these requirements in order to make each requirements' respective NPVs equal zero.

The second threshold estimate, by contrast, calculates the average monetary value each American (on a per capita basis) would need to place annually (over a fifteen year period) on the “existence” of improved accessibility for persons with disabilities (or the “insurance” of improved accessibility for their own potential use in the future) in order for the NPVs for each respective requirement to equal zero. Under this methodology, if Americans on average placed an “existence” value and/or “insurance” value of between 2 cents on the low end to 7 cents on the high end per requirement, then the NPVs for each of these requirements would be zero. Note that this later calculation assumes no added value of avoided humiliation, of increase safety and increased independence.

**Table 20: Additional Threshold Analyses  
(Under Safe Harbor, 50% Readily Achievable Barrier Removal, 1991 Standards for Baseline, 7% Discount Rate)**

Number	Requirements	Main Analysis (million\$)	State-IBC Specific NPV (million\$)	Disability to Reach \$0 NPV	Capita to Reach \$0 NPV
16	Alterations to Existing Elevators	-\$339.00	-\$102	\$0.00	\$0.02
28	Water Closet Clearance in Single-User Toilet Rooms – Out-Swinging Doors	-\$898.40	-\$494	\$0.00	\$0.07
32	Water Closet Clearance in Single-User Toilet Rooms – In-Swinging Doors	-\$974.70	-\$266	\$0.02	\$0.06
37	Side Reach	-\$555.00	-\$153	\$0.00	\$0.02