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Unquantified Benefits and the Problem of Regulation Under Uncertainty

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INTRODUCTION

As the last act of its 2014-2015 Term, the Supreme Court struck down a major EPA regulation limiting mercury emissions from electrical power plants.[1] The legal reason was the EPA's failure to consider the costs of regulating mercury before

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1 *See generally* Michigan v. EPA, 135 S. Ct. 2699, 2705–07 (2015).

deciding that it must be regulated.[2] But the cost of the regulation—$9.6 billion—would not have attracted such attention if it had not seemed so disproportionate to the regulatory benefits. The only mercury-related benefits that the EPA included in its analysis were avoided harms to the children born to women who consumed fish high in mercury while pregnant.[3] Against $9.6 billion in costs, EPA calculated only about $5 million in benefits—a ratio of 1,920 to 1.[4] The imbalance in this ratio had a significant impact upon the Court. As Justice Antonin Scalia wrote for the majority in *Michigan v. EPA*, "One would not say that it is even rational, never mind 'appropriate,' to impose billions of dollars in economic costs in return for a few dollars in health or environmental benefits."[5]

Yet the EPA believed that human exposure to mercury emissions caused significant other harms: developmental delays, memory loss, and behavioral dysfunctions; diminished cardiovascular health; and a variety of toxic immunologic effects.[6] Mercury emissions also harm fish, birds, and mammals, and the recreational hunters and fishermen who catch them. By reducing mercury emissions, the regulation would produce numerous health and environmental benefits. The problem was that the EPA did not quantify any of these benefits in its cost-benefit analysis. They are discussed in the regulation at great length, and the regulation includes citations to scientific and economic studies on these other effects of mercury.[7] But the agency did not place a dollar figure on the value of these benefits.[8] That decision was fatal to the regulation.

This is not the only instance in which an agency has failed to fully quantify the costs or benefits of its regulations. Regula-

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2 *See id.* at 2711.

3 *See* EPA, EPA-452/R-11-011, REGULATORY IMPACT ANALYSIS FOR THE FINAL MERCURY AND AIR TOXICS STANDARDS ES–1 (2011), http://www3.epa.gov/ttnecas1/regdata/RIAs/matsriafinal.pdf [https://perma.cc/X7GF-PEMM]. We describe the legal rule governing the case and the Court's holding in greater detail in Part IV, *infra*.

4 *EPA*, 135 S. Ct. at 2706.

5 *Id.* at 2707 (quoting 42 U.S.C. § 7412(n)(1)(A) (2012)).

6 EPA, *supra* note 3, at ES–10 to –13 tbl.ES–5.

7 *See infra* Part IV.

8 *See, e.g.*, EPA, EPA-452/R-97-003, MERCURY STUDY REPORT TO CONGRESS 4–2 to 4–4 tbl.4–1 (1997), https://www.epa.gov/mercury/mercury-study-report-congress [https://perma.cc/XWM9-UJ28] (containing an eight volume report detailing the magnitude of U.S. mercury emissions and their implications without placing a dollar figure on the benefits); MARTIN HASSAUER ET AL., EUROPEAN FOOD SAFETY AUTH., COLLATE THE LITERATURE ON TOXICITY DATA ON MERCURY IN EXPERIMENTAL ANIMALS AND HUMANS 3–4 (2012) (surveying a vast body of scientific literature on the toxicity of methyl and inorganic mercury).

tory agencies are required to perform cost-benefit analysis (CBA) of major rules.[9] However, in many cases regulators refuse to report a monetized value for the benefits of a rule that they issue: Sometimes, they report no monetized value;[10] at other times, they report a monetized value but also state that not all benefits have been quantified.[11] On occasion, regulators also refuse to monetize or fully monetize costs.[12] These practices raise a puzzle. Cost-benefit analysis is a decision procedure that requires the decision-maker to estimate both the benefits and the costs of a regulation in monetary terms. If a regulator chooses not to monetize all the benefits or all the costs, it is not doing cost-benefit analysis. If it is not doing cost-benefit analysis, what is it doing?

Consider some other examples. The Department of Agriculture (USDA) issued a regulation that modified the school lunch program in light of new research on diet.[13] The USDA estimated a compliance cost of $3.189 billion but refused to monetize benefits because it lacked an empirical basis to estimate the effect of the improved diet on obesity and other health problems.[14] The Department of Homeland Security (DHS) issued a regulation that set standards for the allowable concentration of living organisms in ballast water that ships discharge in U.S. waters.[15] DHS estimated annual compliance costs of

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9 *See* Exec. Order No. 13,563, 3 C.F.R. 215, 215 (2012), *reprinted in* 5 U.S.C. § 601 app. at 102-03 (2012); Exec. Order No. 12,866, 3 C.F.R. 638, 638 (1994), *reprinted as amended in* 5 U.S.C. § 601 app. at 88–92 (2012); OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, CIRCULAR A-4, REGULATORY ANALYSIS 1-3 (2003), https://www.whitehouse.gov/sites/default/files/omb/assets/regulatory_matters_pdf/a-4.pdf [https://perma.cc/6JMU-FZYS].

10 *See, e.g.*, Regulations Restricting the Sale and Distribution of Cigarettes and Smokeless Tobacco to Protect Children and Adolescents, 61 Fed. Reg. 44,396, 44,396, 44,569–71 (Aug. 28, 1996) (to be codified at 21 C.F.R. pts. 801, 803, 804, 807, 820, & 897) (detailing the public health problems caused by cigarettes and smokeless tobacco products as justification for limiting children's and adolescents' access to such products).

11 DEP'T OF JUSTICE: DISABILITY RIGHTS SECTION OF THE CIVIL RIGHTS DIV., FINAL REGULATORY IMPACT ANALYSIS OF THE FINAL REVISED REGULATIONS IMPLEMENTING TITLES II AND III OF THE ADA, INCLUDING REVISED ADA STANDARDS FOR ACCESSIBLE DESIGN 67 (2010), http://www.ada.gov/regs2010/RIA_2010regs/DOJ%20ADA%20Final%20RIA.pdf [https://perma.cc/FW2F-DDPJ].

12 *See, e.g.*, *id.* at vii (noting the presence of "costs that cannot be quantified due to methodological and data constraints").

13 *See generally* Nutrition Standards in the National School Lunch and School Breakfast Programs, 77 Fed. Reg. 4088, 4088 (Jan. 26, 2012) (codified at 7 C.F.R. pts. 210 & 220).

14 *Id.* at 4,122, 4,132–33.

15 *See generally* Standards for Living Organisms in Ships' Ballast Water Discharged in U.S. Waters, 77 Fed. Reg. 17254, 17254 (Mar. 23, 2012) (to be codified at 33 C.F.R. pt. 151 & 46 C.F.R. pt. 162).

$92 million and benefits of $141 to $240 million but further explained that it could not accurately estimate (and hence monetize) most benefits because of the lack of scientific knowledge of the likelihood that organisms discharged from ballast water will invade U.S. territory and of how much economic damage they could cause.[16] And the Department of Justice issued regulations that require prisons to take steps to reduce the incidence of prison rape.[17] The agency estimated costs of $468.5 million per year to improve monitoring and security but refused to estimate benefits because it lacked information needed for estimating the effect of the rule on the prevalence of rape (it did, however, estimate the monetized benefit of an avoided rape).[18] All of these regulations were promulgated despite the absence of a formal cost-benefit analysis that monetized all the costs and benefits.[19]

The Obama administration's recent greenhouse gas regulation (the "Clean Power Plan") similarly includes significant unquantified benefits. The EPA estimated the climate change-related benefits of reducing carbon dioxide emissions as well as related benefits from eliminating particulate matter emissions.[20] However, it left uncalculated a wide range of other related benefits, including reductions in morbidity and mortality due to ozone, nitrous oxide, sulfur oxide, and mercury; environmental benefits to vegetation and animals; and benefits from increased atmospheric visibility and reductions in harm to materials and homes from acid rain and other airborne pollution.[21] Despite these unquantified benefits, EPA nonetheless estimated that the regulation would produce between $49 and $84 billion in net benefits by 2030, using a 3% discount rate.[22]

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16 *Id.* at 17,300–01.

17 *See generally* National Standards to Prevent, Detect, and Respond to Prison Rape, 77 Fed. Reg. 37106, 37106 (June 20, 2012) (codified at 28 C.F.R. pt. 115).

18 *Id.* at 37,110–11.

19 In at least one case, a court invalidated regulations because the agency failed to quantify benefits in a cost-benefit analysis. *See, e.g.*, Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1202–03 (9th Cir. 2008) (holding that the failure of the agency to monetize benefits of the reduction of greenhouse gas emissions was arbitrary and capricious). But these cases are rare.

20 EPA, EPA-452/R-14-002, REGULATORY IMPACT ANALYSIS FOR THE PROPOSED CARBON POLLUTION GUIDELINES FOR EXISTING POWER PLANTS AND EMISSION STANDARDS FOR MODIFIED AND RECONSTRUCTED POWER PLANTS ES 18–19 (2015), http://www2.epa.gov/sites/production/files/2014-06/documents/20140602ria-clean-power-plan.pdf [https://perma.cc/BD5U-DTS8].

21 *See id.* at ES–18 tbl.ES–6.

22 *Id.* at ES–23 tbl.ES–10.

The regulation was cost-benefit justified even without the additional benefits. But the agency's failure to quantify these additional benefits implies that the EPA might have been justified in promulgating an *even stronger* greenhouse gas regulation had it fully accounted for the benefits such a regulation would provide.

If regulators are supposed to perform cost-benefit analysis of major rules, why are so many rules issued without monetized costs and benefits? A tempting explanation is that regulators are sometimes compelled by statute to issue regulations, and so they must do so, whether or not those regulations satisfy a cost-benefit analysis.[23] But there is a deeper problem here. Even in such cases, regulators are required by an executive order to perform cost-benefit analysis.[24] They can conduct a cost-benefit analysis, find that a regulation fails it, and nonetheless issue the regulation with the accompanying cost-benefit analysis. They can explain that they must issue the regulation because of a statute or that they choose to issue the regulation because it has desirable impacts on equity, fairness, or the distribution of wealth. But they must—and should—still provide a valid cost-benefit analysis. The cost-benefit analysis provides information to Congress and the public.[25] If the statute forces the agency to promulgate a regulation whose costs exceed its benefits, a cost-benefit analysis will reveal to Congress that the statute was inefficient and that Congress should repeal or amend it. Yet in most cases agencies do not perform these cost-benefit analyses.

We suspect that it would be embarrassing for a regulator to issue a regulation that fails a cost-benefit analysis by its own admission. Moreover, even if there is a statutory mandate, the regulator may fear that regulation that, by the agency's admission, fails a cost-benefit analysis would be vulnerable to attack in court as arbitrary and capricious.[26] And, whatever the possible outcome of judicial review, agencies that estimate monetized benefits based on limited data will be forced to contend in

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23 *See infra* Part II.

24 *See* Exec. Order No. 13,563, 3 C.F.R. 215, 215 (2012), *reprinted in* 5 U.S.C. § 601 app. at 102-03 (2012); Exec. Order No. 12,866, 3 C.F.R. 638, 638 (1994), *reprinted as amended in* 5 U.S.C. § 601 app. at 88–92 (2012).

25 For instance, under the Congressional Review Act, the Government Accountability Office is required to summarize the cost-benefit analysis of all major rules and make the information available to Congress. *See Congressional Review Act FAQs*, U.S. GOV'T ACCOUNTABILITY OFF., http://www.gao.gov/legal/congressional-review-act/faq [https://perma.cc/XV9Y-5DJJ].

26 *See* Motor Vehicles Mfrs. Ass'n v. State Farm Mut. Auto. Ins., 463 U.S. 29, 46 (1983).

agency hearings and in the political arena with regulated parties who counter with their own estimates. Thus, it will be tempting for regulators to claim unquantifiable benefits even when they can be quantified.

More generally, we suspect that agency failures to fully quantify benefits may be leading to both under- and over-regulation. In some instances, agencies may be justifying regulations that do not pass a cost-benefit test on the basis of unquantified benefits, without any way of knowing whether those unquantified benefits exceed the known costs. In other cases, agencies may be failing to regulate strongly enough because they are not counting all of the benefits of doing so.

To test these hypotheses, we compiled a data set consisting of all major regulations issued by agencies from 2010 to 2013. After analyzing the dataset we come to the following conclusions. First, there are countless examples (far more than we can describe) where agencies fail to fully monetize the benefits and costs of regulations. Second, in most cases, agencies could monetize or partially monetize those benefits and costs. Third, agencies' failures to quantify benefits are almost certainly masking errors of over-regulation and under-regulation. And fourth, even where monetization would be difficult, the agencies could and should have made explicit the implicit valuations they relied on and supported those valuations as much as possible with empirical evidence.

We then proceed to explain how agencies could engage in cost-benefit analysis even when they do not have a reliable basis for estimating valuations. We argue that even where they lack complete data, agency regulators may be able to make reasonable guesses about the harms or benefits from regulations. In many cases, these guesses will be based on the experience and latent knowledge of the agency staff. While agencies should be permitted to "guess"—that is, supply a subjective prior probability—they must also be required to update their estimates as they gain new information. In particular, agencies should be required to (1) provide a mechanism for empirically evaluating their estimates after the regulation is issued; (2) revisit and update their earlier estimates in light of what subsequent studies reveal; and (3) use consistent estimates across agencies. We describe our proposal as loosely "Bayesian"[27] be-

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27 Purists can treat our invocation of the rule as metaphorical if they wish. We use it to refer to the idea that an agent must update her belief about the distribution of outcomes when she receives new information. Bayes' Rule provides the formula for such updating; we have not found it necessary to invoke the

cause of the emphasis on the importance of updating priors as an institutional solution to the problem of regulatory uncertainty.[28]

Our paper is related to two strands in the legal literature. A number of papers have criticized regulatory agencies for failing to properly monetize costs and benefits.[29] The authors of these papers suggest that if benefits cannot be quantified, they should be set at zero.[30] We argue that this view is mistaken. Another group of papers argue about various ways that agencies can deal with hard-to-monetize costs and benefits. Some authors argue that agencies should regulate without monetizing benefits and costs, but these authors have had trouble explaining how they think agencies should decide what to do. For example, John Coates argues that financial regulators should weigh costs and benefits without quantifying them; we do not understand what that could mean.[31] A few efforts have

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formula to make the argument in this paper. We have relied on the subjective rather than frequentist approach to probability, and when we talk about the "Bayesian turn," we mean to push for this idea as well, though technically Bayes' Rule can be used in frequentist probability theory as well.

28 Our argument therefore is similar in spirit to Stephen Charest, *Bayesian Approaches to the Precautionary Principle*, 12 DUKE ENVTL. L. & POL'Y F. 265, 268–70 (2002), although Charest's main interest is how Bayes' Rule may help address concerns underlying the precautionary principle and help reconcile that principle with cost-benefit analysis. *See also* David M. Driesen, *Cost-Benefit Analysis and the Precautionary Principle: Can They Be Reconciled?*, 2013 MICH. ST. L. REV. 771, 812–15 (2013) (making a similar argument). We are skeptical that Bayes' Rule advances the values underlying the precautionary principle, but this debate lies outside the scope of our paper. For a brief discussion of Bayesian approach to cost-benefit analysis of financial regulations, see Robert P. Bartlett, III, *The Institutional Framework for Cost Benefit Analysis in Financial Regulation: A Tale of Four Paradigms?*, 43 J. LEGAL STUD. S379, S397–400 (2014). Finally, there are a few papers that argue in the same spirit as ours that one way to address uncertainty is to revisit regulations and update priors. *See* Yoon-Ho Alex Lee, *An Options Approach to Agency Rulemaking*, 65 ADMIN. L. REV. 881, 909 (2013) (discussing how a regulator in the face of uncertainty can employ a sunset provision to promulgate a rule and update its prior at a later date for a more outcome-based approach); Cass R. Sunstein, *The Regulatory Lookback*, 94 B.U. L. REV. 579, 589–91, 596 (2014) (discussing retrospective reviews of regulations conducted by agencies).

29 *See infra* note 52.

30 *See infra* note 56.

31 *Compare* John C. Coates IV, *Cost-Benefit Analysis of Financial Regulation: Case Studies and Implications*, 124 YALE L.J. 882, 998 (2015) (arguing against quantification), *with* Eric A. Posner & E. Glen Weyl, *Benefit-Cost Analysis for Financial Regulation*, 103 AM. ECON. REV. 393, 393–96 (2013) (proposing principles for quantitative evaluation of regulatory tradeoffs), *and* Eric A. Posner & E. Glen Weyl, *Benefit-Cost Paradigms in Financial Regulation*, 43 J. LEGAL STUD. S1, S1 (2014) (building on the authors' previous work on such quantification). *See generally* Amy Sinden, *Formality and Informality in Cost-Benefit Analysis*, 2015 UTAH L. REV. 93, 120–62 (2015) (cataloguing the use of cost-benefit analysis by academics and the federal government).

been made to supply agencies with a formal framework for acting in the face of unquantified benefits.[32] Contrary to these approaches, in this paper we suggest how agencies might engage in quantitative analysis even in the face of uncertainty.

I
THE MODERN STATE OF COST-BENEFIT ANALYSIS

An enormous literature describes CBA, how it is used in government, and whether it is appropriate for regulators to employ it.[33] For reasons of space, we will skip over most of these issues, and focus on those features of CBA and its history that are relevant to the present inquiry into the problem of unquantified benefits.

A. Cost-Benefit Analysis

Cost-benefit analysis is a decision-procedure that an agent uses to decide whether or not to take a course of action.[34] To use CBA, the agent determines the costs and benefits of the action in monetary terms and engages in the action only if the benefits exceed the costs.[35]

When regulators use CBA, they should—in theory—perform a rigorous analysis based on available empirical data; "guesstimates" will not do.[36] Consider the USDA's school lunch program.[37] If the program requires schools to provide children with apples rather than a bag of potato chips, then the cost of the program is the price of an apple minus the price of the bag of potato chips multiplied by the number of children who receive lunches under the program. A sophisticated cost-

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32 *See, e.g.*, Cass R. Sunstein, *The Limits of Quantification*, 102 CAL. L. REV. 1369, 1387–90 (2014) (advocating the use of "breakeven analysis"); Adrian Vermeule, *Rationally Arbitrary Decisions (in Administrative Law)*, 44 J. LEGAL STUD. S475, S480–81 (2015) (arguing for deferential review of agency-level decisions regarding costs and benefits under uncertainty).

33 The literature is too vast to cite. For book-length treatments, see MATTHEW D. ADLER & ERIC A. POSNER, NEW FOUNDATIONS OF COST-BENEFIT ANALYSIS (2006); RICHARD L. REVESZ & MICHAEL A. LIVERMORE, RETAKING RATIONALITY (2008); CASS R. SUNSTEIN, THE COST-BENEFIT STATE: THE FUTURE OF REGULATION PROTECTION (2002).

34 *See* ADLER & POSNER, *supra* note 33, at 6.

35 Ideally, the agency would select the regulation that maximizes benefits net of costs.

36 Thus, when we refer to CBA, we mean "formal" rather than "informal" CBA, where the latter refers merely to the idea of balancing. *See* Sinden, *supra* note 31, at 99 (explaining the differences between a formal, quantified CBA and an informal, qualitative CBA).

37 *See generally* Nutrition Standards in the National School Lunch and School Breakfast Programs, 77 Fed. Reg. 4088, 4088 (Jan. 26, 2012) (codified at 7 C.F.R. pts. 210 & 220).

benefit analysis would take account of other factors as well—for example, that it may be more expensive to store and handle apples (which can bruise and rot) than bags of potato chips, that their prices may fluctuate, and so on. Sometimes, regulators overestimate costs because they fail to anticipate how new technologies develop that reduce costs.[38] That said, cost estimates are usually straightforward exercises in accounting and can take advantage of data that industry, government, and academia have collected for their own purposes.

By contrast, determining the monetary benefits of a regulation is often difficult.[39] If children are given apples rather than potato chips, they may throw away the apples rather than eat them. They may use pocket money to get their carbohydrate fix from a vending machine or after school. If some children eat apples, it is possible that the additional nutritional benefit will, in fact, have zero or trivial health effects. So there is an initial question about whether the regulation will have the intended effect on behavior and a second question about whether, even if it does, the effect will be positive. And then a third question is how to measure positive effects. Sometimes, this will be easy. If the school lunch program reduces the number of children who become diabetic, then the benefits associated with reducing the incidence of diabetes may be calculated. But other benefits may be real but hard to value in monetary terms. Thinner children may enjoy enhanced self-esteem and more energy, which may improve their studies; but all of these things will be hard to put in monetary terms because there is no market in self-esteem or energy and hence no market value for these things.

To sum up, let us distinguish between two sources of ambiguity in the calculation of benefits. First, there is a *causation problem*, by which we mean empirical uncertainty as to whether a regulation will have intended behavioral effects. Second, there is a *monetization problem*: certain benefits are hard to monetize because no market exists in those benefits. Both problems can tempt a regulator to argue that a regulation has unquantifiable benefits.

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38 *See* HART HODGES, ECON. POLICY INST., FALLING PRICES: COST OF COMPLYING WITH ENVIRONMENTAL REGULATIONS ALMOST ALWAYS LESS THAN ADVERTISED 6 (1997); Thomas O. McGarity & Ruth Ruttenberg, *Counting the Cost of Health, Safety, and Environmental Regulation*, 80 TEX. L. REV. 1997, 2031 (2002).

39 *See, e.g.*, Sunstein, *supra* note 32, at 1375–76 (explaining that quantifying benefits is difficult because of epistemic problems, objections to standard economic thinking about monetization, and incommensurability).

B. The Institutional Structure

Regulators derive their authority to regulate from statutes enacted by Congress, but these statutes rarely direct regulators to use CBA.[40] Most statutes provide general standards for improving public health or safety or achieving other goals.[41] Courts have given regulators wide latitude to interpret these statutes, and this has given them a great deal of freedom to choose the stringency, scope, and method of regulation, as long as they provide an adequate explanation for the regulation they choose.[42]

Before the 1980s, some regulators informally used cost-benefit analysis to justify regulations.[43] In 1981, President Reagan signed an executive order that required most regulators to perform cost-benefit analysis for major regulations (those having an economic impact of at least $100 million per year).[44] The executive order was controversial at the time. Many people believed that it erected bureaucratic hurdles for the purpose of blocking or delaying needed regulations.[45] But all subsequent presidents, including Bill Clinton and Barack Obama, extended Reagan's CBA with some modifications.[46] CBA now has adherents on both the left and right who believe that it is a sensible, technocratic device for ensuring that a regulation is rational rather than arbitrary, though it remains controversial.[47]

Today, most regulators are required to perform CBAs and do so—in the sense of doing the necessary calculations, or some of them, and reporting the results—for all major regulations. They report their calculations in Regulatory Impact As-

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40 *But see* Michigan v. EPA, 135 S. Ct. 2699, 2711 (2015) (holding that the Clean Air Act requires the EPA to consider costs, even if it need not necessarily conduct full-blown CBA).

41 *See, e.g.*, 42 U.S.C. § 7412 (2012) (providing that the Administration shall regulate electric utility steam generating units if the Administrator finds it "appropriate and necessary").

42 *See, e.g.*, Chevron U.S.A. Inc. v. Nat. Res. Def. Council, Inc., 467 U.S. 837, 865 (1984) ("[A]n agency to which Congress has delegated policymaking responsibilities may . . . properly rely upon the incumbent administration's views of wise policy to inform its judgments.").

43 Adler & Posner, *supra* note 33, at 11.

44 *See* Exec. Order No. 12,291, 3 C.F.R. 127, 127–28 (1982) (revoked in 1993).

45 *See* ADLER & POSNER, *supra* note 33, at 2–4.

46 *See* Exec. Order No. 13,563, 3 C.F.R. 215, 215–17 (2012), *reprinted in* 5 U.S.C. § 601 app. at 102-03 (2012); Exec. Order No. 12,866, 3 C.F.R. 638, 638–40 (1994), *reprinted as amended in* 5 U.S.C. § 601 app. at 88–92 (2012).

47 For criticisms, see generally FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING 93–96 (2004).

sessments (RIAs) that accompany the regulations.[48] However, as we will see, they do not always quantify benefits. And it is not clear that even when regulators do a proper CBA, they follow it. There are a number of reasons for this. First, the executive orders that require CBA are not legally enforceable.[49] Regulators are required to submit proposed regulations along with associated CBAs to the Office of Information and Regulatory Affairs (OIRA), which is in the Office of Management and Budget (OMB) in the White House, but OIRA, OMB, and the president are free to waive or relax the CBA standard if they wish to.[50] Second, at least some statutes either forbid regulators to use CBA or make it difficult for them to do so because they impose specific requirements on regulators. For example, when statutes tell a regulator to reduce pollution below a specified quantitative threshold that is itself not cost-justified, the regulator must do so, regardless of what its own CBA may tell it. In this context, the executive order functions as a reporting requirement; it does not supersede statutory language. Adding to the confusion, courts sometimes disagree about when regulators must use CBA, may use it, and cannot use it.[51]

C. The Debate on Unquantified Benefits

In a number of influential papers published in the 1980s and 1990s, a group of scholars argued that many of the regulations issued by the U.S. government failed cost-benefit analysis.[52] In several of these papers, the scholars pointed out that agencies often justified regulations based on unquantified ben-

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48 *See* OFFICE OF INFO. & REGULATORY AFFAIRS, REGULATORY IMPACT ANALYSIS: A PRIMER 1 (2011), https://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf [https://perma.cc/AAZ4-9SXR]; OFFICE OF MGMT. & BUDGET, *supra* note 9, at 1–3.

49 *See In re* Surface Mining Regulation Litig., 627 F.2d 1346, 1357 (D.C. Cir. 1980) ("[E]xecutive orders without specific foundation in congressional action are not judicially enforceable in private civil suits.").

50 *See* ADLER & POSNER, *supra* note 33, at 80–87.

51 *See* Entergy Corp. v. Riverkeeper, Inc., 556 U.S. 208, 226 (2009) (holding that the EPA was permitted to use cost-benefit analysis in the face of an ambiguous statute).

52 *See* ROBERT W. HAHN, REVIVING REGULATORY REFORM: A GLOBAL PERSPECTIVE 32 (2000); Robert W. Hahn & Paul C. Tetlock, *Has Economic Analysis Improved Regulatory Decisions?*, 22 J. ECON. PERSP. 67, 80 (2008); Robert W. Hahn, *Regulatory Reform: What Do the Government's Numbers Tell Us?*, *in* RISKS, COSTS, AND LIVES SAVED: GETTING BETTER RESULTS FROM REGULATION 208, 208 (Robert W. Hahn ed., 1996); John F. Morrall III, *A Review of the Record*, 10 REG. 25, 29–34 (1986); Tammy O. Tengs & John D. Graham, *The Opportunity Costs of Haphazard Social Investments in Life-Saving*, *in* RISKS, COSTS, AND LIVES SAVED: GETTING BETTER RESULTS FROM REGULATION, *supra*, at 167.

efits.[53] If these unquantified benefits are assumed to be zero, then the regulations were not cost-justified. The most recent study, published in 2007, confirms that regulators frequently fail to fully monetize all of the claimed benefits of regulations.[54]

For example, in a well-known paper, Robert Hahn compiled a dataset of 136 regulations.[55] Hahn assigned a zero benefit to dozens of regulations because the agencies that issued them did not provide a monetary value for the benefits.[56] The regulations included rules requiring oil tankers to have double hulls, protecting agricultural workers from toxic pesticides, and limiting toxic pollutants in drinking water. While it is possible that each of these regulations produced zero *net* benefits, it is hard to believe that they did not produce any benefits at all, as Richard Parker has pointed out.[57]

Consider, for example, the EPA's 1995 municipal waste combustor rule.[58] The regulation was designed to reduce a range of dangerous emissions—including particulate matter, acid gases, nitrogen oxide, dioxin, cadmium, mercury, and lead. However, the EPA believed that it was possible to assign valuations to reductions of only the first three substances. While it was known that dioxin, cadmium, mercury, and lead are dangerous when ingested, the EPA did not have data that permitted it to estimate monetized benefits of reduced exposure to them.[59] For that reason, Hahn simply disregarded the benefits of these rules.[60] Parker responds persuasively that it would have been wrong for the EPA to disregard these benefits because it is clear that they are not zero.[61]

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53 *See, e.g.*, Robert W. Hahn & Patrick M. Dudley, *How Well Does the U.S. Government Do Benefit-Cost Analysis?*, 1 REV. ENVTL. ECON. & POL'Y 192, 200 (2007) (noting that the "estimation of benefits lags well behind the estimation of costs"); Amy Sinden, The Problem of Unquantified Benefits (2016) (unpublished manuscript) (on file with author) (finding similar results).

54 *See id.* at 200–01.

55 Hahn did estimate benefits for some regulations for which the agency did not. *See* Robert W. Hahn, *The Economic Analysis of Regulation: A Response to the Critics*, 71 U. CHI. L. REV. 1021, 1036 (2004).

56 *See id.*

57 Richard W. Parker, *Grading the Government*, 70 U. CHI. L. REV. 1345, 1382 (2003).

58 *See generally* Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Municipal Waste Combustors, 60 Fed. Reg. 65,387, 65,387–88 (Dec. 19, 1995) (codified at 40 C.F.R. pt. 60).

59 EPA, *supra* note 3, at ES–9, ES–10 tbl.ES–5, ES–11 to ES–13 tbl.ES–6, 1–5.

60 Hahn, *supra* note 55, at 1037.

61 Parker, *supra* note 57, at 1393–94.

In response to Parker's criticisms, Hahn argues that "there is no simple alternative for filling gaps in an agency's analysis."[62] He continues:

> In short, I think it is not unreasonable to assign a zero dollar value to unquantified benefits and cost categories for three reasons. First, it gives regulatory agencies an incentive to provide more information on quantifiable benefits and costs. Second, any other assumption seems totally arbitrary in the absence of information on the actual non-quantified benefits and costs. Third, the measure of *quantifiable* net benefits should be used in conjunction with nonquantifiable benefits and costs to reach a decision. Exactly how is a matter of some debate.[63]

There are problems with each one of these responses. If it is expensive or impossible for regulators to obtain adequate information, then there is no point in giving them an incentive to do so. Moreover, as we will argue, the assumption that unquantified benefits are worth zero is less justified than using a subjective prior. Finally, the argument that a regulator may disregard a cost-benefit analysis by citing unquantified benefits just gives away the game. Hahn cannot claim that regulators acted wrongly if he believes that they are permitted to do this.

Yet, there is some common ground between Parker and Hahn. In his discussion of the EPA's municipal waste combustor rule, Parker says:

> However, EPA shares a measure of blame for the omission. While EPA devotes several pages to documenting the toxicity of heavy metals and dioxins in the abstract, nowhere (not even in the two-hundred-page Economic Impact Assessment buried in its docket room) does EPA address the fundamental, priority-setting questions facing risk managers in that rule: (1) Are current levels of emissions of heavy metal and dioxin creating a significant human health or ecosystem risk? (2) What portion of total emissions, and total risk from emissions, is accounted for by hazardous waste combustors?
>
> While it may be unfair (given data limitations) to ask for numbers in response to these questions, surely courts, policymakers, and the public are entitled to some explanation of why agency risk managers deem emissions from waste combustors a significant risk. We are left with a record that fails to fully prove the rationality of the rule.[64]

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62 Hahn, *supra* note 55, at 1037.

63 *Id.* at 1037–38.

64 Parker, *supra* note 57, at 1394.

Parker agrees with Hahn that a regulator acts wrongly by failing to disclose or compile relevant information about the expected effect of the regulation on emissions and human health. But Parker's statement is as puzzling as Hahn's. Suppose the EPA stated that current emissions of heavy metal and dioxin threaten human health "substantially" or "significantly." Is this sufficient? Affected parties would be justified in asking the EPA why a certain risk is substantial, and it is hard to see how the EPA could answer this question without quantifying the risk. Parker does not seem to think the EPA should be required to provide "numbers," but why not? And if the answer is that there is not enough data, then what exactly did the EPA do wrong in the first place?

II
UNQUANTIFIED BENEFITS

We turn now to the practice of regulators. Our goal is to provide a systematic analysis of unquantified benefits in cost-benefit analysis. As we noted above, several scholars have conducted large-scale studies of agency regulations.[65] However, none of these studies focused on the rate at which agencies fail to quantify benefits or their reasons for failing to do so.[66] Those papers were concerned instead with whether the regulations passed a cost-benefit test. In this Part, we take up the issue of nonquantification directly. In the sections that follow, we examine the extent to which agencies fail to quantify costs and benefits, the reasons they give for failing to do so, and the extent to which agency practices differ. We then focus briefly on the particular issue of unquantified costs.

A. The Extent of Nonquantification

We collected every major regulation issued by every regulatory agency from 2010 through 2013.[67] This included a total of

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65 *See* sources cited *supra* note 52.

66 The most closely related study is Hahn & Dudley, *supra* note 53, at 199–203. Using a sample of regulations drawn from the Reagan, Bush, and Clinton administrations, the authors tabulate the number of regulations with fully and partially quantified costs and benefits. This is similar to the initial step in our analysis of Obama administration regulations, which we describe in Table 1, *infra*. Hahn & Dudley do not consider any of the other issues we address below, including analyzing the reasons for agency quantification or non-quantification, differences in behavior across agencies, and the extent to which quantification would appear possible.

67 OMB defines a major regulation as one that is expected to have an economic impact in excess of $100 million. OFFICE OF MGMT. & BUDGET, *supra* note 9, at 41.

106 major rules, promulgated by fourteen agencies, including some cases in which two agencies worked in tandem. Agencies were able to fully quantify the regulatory costs and benefits in only *two* of these 106 regulations. There were forty-eight other regulations in which agencies were able to partially quantify both costs and benefits, meaning that the agency calculated some (nonzero) costs and benefits while nonetheless acknowledging that its calculations were incomplete. In fifty-six of the regulations, the agency was unable to attach any number to either costs or benefits (or both). Of those fifty-six regulations, thirty-six involved entirely unquantified benefits, nine involved entirely unquantified costs, and eleven involved both unquantified benefits and costs. Table 1 summarizes these findings.

TABLE 1. REGULATIONS BY EXTENT OF QUANTIFICATION OF BENEFITS AND COSTS.

Partly quantified costs and benefits	48
Did not quantify benefits	36
Did not quantify costs	9
Did not quantify benefits and costs	11

Those numbers, viewed in isolation, appear to paint a dismal picture of agency behavior. Agencies are operating despite a dearth of information, and in many cases the uncertainty that surrounds their actions might be causing (or allowing) them to regulate in ways that do not result in net social benefits. To be sure, in forty-four of the forty-eight regulations with partially quantified costs and benefits, the calculated benefits exceed the costs. And only in four cases—three regulations promulgated by the Department of Transportation (DOT) and one by the EPA—did an agency promulgate a regulation where the known costs exceed the known benefits.[68] Moreover, in three of these four cases, the agency issued the regulation not because it believed that the

68 *See* Pilot Certification and Qualification Requirements for Air Carrier Operations, 78 Fed. Reg. 42324, 42326–27 tbl.2 (July 15, 2013) (codified at 14 C.F.R. pts. 61, 121, 135, 141 & 142); Automatic Dependent Surveillance—Broadcast (ADS–B) Out Performance Requirements to Support Air Traffic Control (ATC) Service, 75 Fed. Reg. 30160, 30163 (May 28, 2010) (codified at 14 C.F.R. pt. 91); Water Quality Standards for the State of Florida's Lakes and Flowing Waters, 75 Fed. Reg. 75762, 75802–03, 75803 tbl.VI(F)(a) (Dec. 6, 2010) (codified at 40 C.F.R. pt. 131); Positive Train Control Systems, 75 Fed. Reg. 59108 (Sept. 27, 2010) (codified at 49 C.F.R. pt. 236); FED. R.R. ADMIN., DEP'T OF TRANSP., FRA-2006-0132, REGULATORY IMPACT ANALYSIS 1 (2009), https://www.fra.dot.gov/eLib/Details/L01344 [https://perma.cc/A5B8-MWS8].

regulation would be cost-justified if the unquantified benefits were included, which is necessarily speculative, but because the agency was obligated to regulate by statute. Still, the overall record is grim: regulatory agencies are regulating in the dark.

The DOT's 2013 regulation of Pilot Certification and Qualification Requirements is illustrative.[69] The regulation required all commercial airline pilots, including pilots who were second in command of an airplane, to obtain an Airline Transport Pilot (ATP) certificate that required 1500 hours of flying time.[70] (Prior regulations only required that pilots in command of an airplane obtain such a certificate.)[71] The DOT admitted that the regulation would produce relatively few safety benefits but significant costs, mainly to the pilots who were forced to undergo additional training. It estimated that the regulation would produce $23 million in benefits via avoided accidents.[72] The FAA calculated the likely costs at $312.7 million, predominantly in the form of additional expenditures (both time and money) by pilots seeking certification.[73] (There were some unquantified benefits, but the agency believed them to be relatively small.)[74] However, as the DOT explained, this regulatory change was mandated by a federal statute—the Airline Safety and Federal Aviation Extension Act of 2010.[75] The agency explained that the costs were "statutory costs" and noted that "the costs associated with the requirement for [second in command pilots] to have an ATP certificate are attributable to the statute, not to this regulation."[76] The agency's hands were tied.

Another DOT regulation, this one governing railroad control systems, was similarly mandated by the Railroad Safety Improvement Act of 2008.[77] And a 2011 EPA regulation governing water quality in Florida was initiated by a citizen suit against the EPA brought by environmental groups.[78] In both

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69 *See generally* Pilot Certification and Qualification Requirements for Air Carrier Operations, 78 Fed. Reg. at 42324.

70 *Id.* at 42362, 42368.

71 *See id.* at 42324.

72 *Id.* at 42359.

73 *Id.* at 42327 tbl.2.

74 *Id.* at 42364.

75 *See id.*

76 *Id.* at 42326.

77 *See generally* Positive Train Control Systems, 75 Fed. Reg. 59108, 59108 (Sept. 27, 2010) (codified at 49 C.F.R. pt. 236).

78 *See* 40 C.F.R. § 131.10(b) (2011); EPA, 820-F-12-056, PROPOSED NUTRIENTS STANDARDS FOR FLORIDA'S STREAMS AND PROPOSED DOWNSTREAM PROTECTION VALUES

cases, the agencies stated plainly that they would not have regulated absent these obligations.

As for the regulations without any quantifiable benefits, one important point is that regulations with unquantified benefits were either relatively low-cost or compelled by statute. Recall that there were thirty-six regulations in our sample for which an agency quantified at least some costs but could not quantify any benefits. These regulations averaged roughly $150 million in costs (per regulation).[79] By comparison, the forty-eight regulations for which the EPA quantified both costs and benefits—and for which benefits outweighed costs in nearly all cases—averaged approximately $750 million in costs (per regulation). In addition, among all of the regulations with unquantified benefits, the two regulations with the greatest costs involved implementations of the Affordable Care Act. One was a 2013 regulation that involved the administration of expanded Medicaid programs and children's health insurance; this regulation was expected to produce a cost of slightly more than $1 billion.[80] The other was a 2012 regulation dealing with the establishment and administration of federal and state insurance exchanges. This regulation was expected to carry a cost of $3.4 billion over five years.[81] The Department of Health and Human Services did not attempt to calculate the regulatory benefits because it did not believe it could separate the benefits of these particular regulations from the benefits of the Affordable Care Act as a whole.[82]

FOR LAKES 1 (2012), https://www.epa.gov/sites/production/files/2015-07/documents/factsheet-remand-2012.pdf [https://perma.cc/GU7J-CDZS]. That rule was later withdrawn when Florida promulgated its own environmental regulations governing the same waterways. *See* Water Quality Standards for the State of Florida's Lakes and Flowing Waters; Withdrawal, 79 Fed. Reg. 57447, 57447 (Sept. 25, 2014) (codified at 40 C.F.R. pt. 131).

79 That figure excludes four regulations that had negative costs. When a regulation that is no longer cost-benefit justified is repealed, the agency typically records the benefits of repeal as negative costs, rather than positive benefits. When those four regulations are included, the average cost falls to roughly $100 million.

80 Medicaid and Children's Health Insurance Programs: Essential Health Benefits in Alternative Benefit Plans, Eligibility Notices, Fair Hearing and Appeal Processes, and Premiums and Cost Sharing; Exchanges: Eligibility and Enrollment, 78 Fed. Reg. 42160, 42298 tbl.4 (July 15, 2013) (codified at 42 C.F.R. pts. 431, 435, 436, 438, 440, 447, & 457; 45 C.F.R. pts. 155 & 156).

81 Patient Protection and Affordable Care Act; Establishment of Exchanges and Qualified Health Plans; Exchange Standards for Employers, 77 Fed. Reg. 18310, 18441 tbl.1 (Mar. 27, 2012) (codified at 45 C.F.R. pts. 155–57).

82 DEP'T OF HEALTH AND HUMAN SERVS., PATIENT PROTECTION AND AFFORDABLE CARE ACT; ESTABLISHMENT OF EXCHANGES AND QUALIFIED HEALTH PLANS, EXCHANGE STANDARDS FOR EMPLOYERS (CMS-9989-FWP) AND STANDARDS RELATED TO REINSURANCE, RISK CORRIDORS AND RISK ADJUSTMENT (CMS-9975-F) 11–12 (2012),

B. Explanations for Nonquantification

In more than 74% of the regulations in our data, the agency stated that it could not quantify all of the relevant benefits or costs because of empirical uncertainty—missing data, modeling difficulties, or other related effects. There were only nine regulations in which the agency claimed that a benefit or cost was not quantifiable as a matter of principle. Table 2 summarizes these statistics:

TABLE 2. FREQUENCY OF AGENCY EXPLANATIONS FOR FAILURE TO QUANTIFY BENEFITS AND COSTS.

Explanation	**Frequency**
Empirical uncertainty	77
Benefit/cost is not quantifiable in principle	9
Other	14
No explanation provided	10

*Note: numbers do not sum to 106 because in some cases an agency provided multiple rationales.

Of the nine regulations for which the agency declared that the benefit was unquantifiable in principle, six involved arguments by the agency that the benefits included "values . . . including equity, human dignity, fairness, and distributive impacts"[83] that could not be quantified. Yet in all of these cases, the agency expected the regulation to produce significant market-related benefits that the agency could and should have calculated. For instance, in 2011 the Equal Employment Opportunity Commission (EEOC) promulgated a regulation that expanded the conditions under which employees could be classified as disabled and receive reasonable accommodations under the Americans with Disabilities Act.[84] The regulation was expected to produce dignitary benefits to certain employees who, the agency believed, would no longer face discrimination. But those were not the only benefits the agency expected the regulation to yield. In addition, the EEOC speculated that employees who

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https://www.cms.gov/CCIIO/Resources/Files/Downloads/hie3r-ria-032012.pdf [https://perma.cc/488Z-BTZW]. These two regulations were also mandated by statute, and the Department of Health and Human Services had no choice but to promulgate them.

83 *See* Exec. Order No. 13,563, 3 C.F.R. 215, 216 (2012), *reprinted in* 5 U.S.C. § 601 app. at 102-03 (2012).

84 *See generally* Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act, as Amended, 76 Fed. Reg. 16978, 16978–79 (Mar. 25, 2011) (codified at 29 C.F.R. pt. 1630).

received accommodations might become more productive and that employers would benefit by retaining employees who would otherwise quit. One commenter supplied dollar estimates of this benefit, citing research indicating that reasonable accommodations could be worth between $1,000 and $5,500 per worker.[85] Yet the agency did not attempt to quantify any of these benefits or measure them against the costs. (We discuss this regulation in greater detail below.)

Similarly, in 2013 the Department of Labor (DOL) issued a regulation prohibiting discrimination in employment against particular categories of military veterans.[86] The agency invoked Executive Order 13,563 and explained that its "analysis of the benefits of this proposal emphasizes the non-monetary benefits," including "values that are difficult or impossible to quantify, including equity."[87] Executive Order 13,563 does instruct agencies to include benefits such as equity, human dignity, and fairness in their analyses, even when those benefits are difficult or impossible to quantify. However, the benefits that the DOL ascribes to this regulation are straightforward. The DOL argued that the rule will "facilitate the connection of job-seeking veterans with contractors looking to hire" and that it "provides increased tools with which the contractor can assess its affirmative action efforts."[88] These benefits, and the few others listed, are not the type of inchoate goods that the quoted language from Executive Order 13,563 contemplated. To the contrary, they are labor market advantages that the DOL should have been able to quantify. Yet the agency makes no effort to do so, instead concluding: "[The DOL] believes that the final rule will have extensive benefits for veterans who are prospective and current employees of Federal contractors and Federal contractors. As such, [the DOL] concludes that the benefits of the rule justify the costs."[89] Four other regulations followed the same template.[90]

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85 *Id.* at 16996.

86 *See generally* Affirmative Action and Nondiscrimination Obligations of Contractors and Subcontractors Regarding Special Disabled Veterans, Veterans of the Vietnam Era, Disabled Veterans, Recently Separated Veterans, Active Duty Wartime or Campaign Badge Veterans, and Armed Forces Service Medal Veterans, 78 Fed. Reg. 58614, 58614 (Sept. 24, 2013) (codified at 41 C.F.R. pts. 60–250 & 60–300).

87 *Id.* at 58656 (quoting Exec. Order No. 13,563, 3 C.F.R. at 216).

88 *Id.*

89 *Id.*

90 *See generally* National Standards to Prevent, Detect, and Respond to Prison Rape, 77 Fed. Reg. 37106, 37106 (June 20, 2012) (codified at 28 C.F.R. pt.

While it is tempting to argue that any regulation dealing with disabled people or veterans must involve nonquantifiable benefits, we believe that the agencies' invocation of boilerplate language from Executive Order 13,563 is precisely what must be avoided. Some benefits like human dignity might well be monetizable, as we argue below. But even if they are not, the agency should still conduct a cost-benefit analysis that takes into account all the monetizable benefits. It should then separately state that the regulation should be issued because of identified dignitary benefits, even if it fails a cost-benefit analysis. With respect to equity and distributive impacts, the agency should also conduct a cost-benefit analysis and explain that the regulation should be issued because of the distributive impacts, even though it fails a cost-benefit analysis.

Moreover, the analysis of distributive impacts should be rigorous rather than conclusory. The DOL should have actually explained how the rule would advance equity by estimating the impact of the rule on the wealth of veterans.[91] Such an estimate would not have been difficult to provide. The DOL possesses information about the income and employment rate of classes of veterans.[92] Indeed, according to this information, veterans have, on average, a *lower* unemployment rate and *higher* median income than nonveterans do.[93] This strongly suggests that a program that generically helps veterans may well have perverse distributive impacts unless it is carefully designed to help veterans who are the least well-off. If the DOL cannot demonstrate that the distributive impacts are positive, then it should not be able to cite distributive values as a reason for issuing the regulation.

In other cases, the regulations were promulgated to implement the Affordable Care Act, and the agency explained

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115); Nondiscrimination on the Basis of Disability in State and Local Government Services, 75 Fed. Reg. 56164, 56164 (Sept. 15, 2010) (codified at 28 C.F.R. pt. 35); Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities, 75 Fed. Reg. 56236, 56236–37 (Sept. 15, 2010) (codified at 28 C.F.R. pt. 36); Medical Examination of Aliens—Removal of Human Immunodeficiency Virus (HIV) Infection from Definition of Communicable Disease of Public Health Significance, 74 Fed. Reg. 56547, 5551 (Nov. 2, 2009) (codified at 42 C.F.R. pt. 34) (noting reduction in "stigma of HIV-infected persons").

91 We are not arguing that the valuations used in the cost-benefit analysis should be given distributional weights, as has sometimes been advocated. We argue that the distributive impact should be calculated separately from the cost-benefit analysis.

92 *See* U.S. DEP'T OF LABOR, THE VETERAN LABOR FORCE IN THE RECOVERY 2, 2 tbl.1 (2011), https://www.dol.gov/_sec/media/reports/VeteransLaborForce/VeteransLaborForce.pdf [https://perma.cc/2JV5-9CTL].

93 *See id.* at 2, 2 tbl.2.

that it was impossible—both practically and as a matter of principle—to separate the benefits created by the particular regulation at hand from the benefits of the larger statute. This was the issue with respect to two regulations issued in 2013 by the Department of Health and Human Services: one to establish guidelines for coverage of essential health benefits[94] and another to set standards related to the expansions of Medicaid and the Children's Health Insurance Programs.[95]

The last case comes from a 2010 Department of the Treasury regulation governing the manner in which agencies disburse benefits to citizens.[96] The regulation required all individuals receiving benefits from federal agencies to receive payment of those benefits via electronic funds transfer—that is, direct deposit. Among the unquantifiable costs of this regulation, the agency included "intangible emotional costs for individuals who are fearful or resistant to direct deposit."[97]

We do not think that these costs would be difficult to quantify. There are numerous ways to determine how much an individual might value not having to receive direct deposits. The agency might calculate how much time and money the typical individual spends in order to use her preferred nondirect method of deposit—mailing letters, going to the bank, etc. (This is a type of revealed preference analysis.[98]) Alternatively, the agency might simply ask people how much additional money they would need to be offered to accept direct deposit in lieu of their current deposit method (a stated preference approach).[99] The fact that the benefits are "emotional" does not mean that they are unmeasurable. We suspect that the agency simply believed that the benefits were

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94 *See generally* Patient Protection and Affordable Care Act; Standards Related to Essential Health Benefits, Actuarial Value, and Accreditation, 78 Fed. Reg. 12834, 12834 (Feb. 25, 2013) (codified at 45 C.F.R. pts. 147, 155, & 156).

95 *See generally* Medicaid and Children's Health Insurance Programs: Essential Health Benefits in Alternative Benefit Plans, Eligibility Notices, Fair Hearing and Appeal Processes, and Premiums and Cost Sharing; Exchanges: Eligibility and Enrollment, 78 Fed. Reg. 42160, 42160 (July 15, 2013) (codified at 42 C.F.R. pts. 431, 435, 436, 438, 440, 447, & 457; 45 C.F.R. pts. 155 & 156).

96 *See generally* Management of Federal Agency Disbursements, 75 Fed. Reg. 80315, 80315 (Dec. 22, 2010) (codified at 31 C.F.R. pt. 208).

97 *Id.* at 80330.

98 *See* Eric P. Kroes & Robert J. Sheldon, *Stated Preference Methods: An Introduction*, 22 J. TRANSP. ECON. & POL'Y 11, 12–16 (1988) (explaining the difference between stated preference methods and revealed preferences); *see also* Paul A. Samuelson, *Consumption Theory in Terms of Revealed Preference*, 15 ECONOMICA 243, 243–51 (1948) (offering a proof for the economic theory of revealed preferences).

99 *See* Kroes & Sheldon, *supra* note 98, at 12–16.

too small to be worth measuring; the benefits might have been exceeded by the cost of performing a study to calculate them. If this was its reason, the agency should have said so.

In contrast to the few regulations where an agency claimed that a particular benefit or cost was unquantifiable in principle, there are seventy-seven regulations in our dataset in which an agency announces that it lacks the empirical information necessary to make such a calculation. There are a wide variety of types of unquantified benefits and costs across those seventy-seven regulations, but an examination of the regulations reveals several patterns.

First, in some cases it appears that the unquantified benefits could be quite large. One example is a 2010 regulation issued by the Department of the Interior imposing increased safety measures for deepwater oil and gas drilling in the wake of the BP oil spill.[100] The *only* asserted benefit of the new safety measures was the prevention of another catastrophic oil spill, but the agency did not offer an estimate of this benefit. It noted that there had been 4,123 deepwater wells drilled but only one catastrophic spill (the BP spill), and so it estimated the probability of a catastrophic spill at 1 in 4,123 for any new well that is being drilled.[101] (This raises the question of why the agency was not considering the benefits of avoiding noncatastrophic spills as well.) However, the agency could not estimate the reduced probability of such a spill from the safety measures it was implementing. It noted a Canadian Energy Board study that estimated risk reductions from similar (though not identical) safety measures but then announced that it lacked "sufficient data that would allow adapting that methodology to the change in the probability of blowout associated with . . . this rulemaking."[102] In addition to its inability to calculate the reduced probability of a spill, the

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100 *See* Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf, 75 Fed. Reg. 63346, 63346 (Oct. 14, 2010) (codified at 30 C.F.R. pt. 250).

101 BUREAU OF OCEAN ENERGY MGMT., BENEFIT-COST ANALYSIS FOR THE INTERIM FINAL RULE ON INCREASED SAFETY MEASURES FOR ENERGY DEVELOPMENT ON THE OUTER CONTINENTAL SHELF: RIN 1010 AD68 7 (2010). This calculation is pretty questionable. A better approach would have taken into account the number of years the wells have been in operation and calculated the annual probability of a catastrophic spill. If the wells had different characteristics relevant to the risk of a spill (location, manner of construction, types of safety features, etc.), then these different characteristics should have been accounted for as well.

102 *Id.* at 19.

agency did not estimate the economic benefits of avoiding a spill.[103]

Second, when agencies are unable to fully calculate a benefit, they almost never produce all of the information available to them and hazard a best guess. In the vast majority of cases, the agency will simply announce that the benefit cannot be calculated, explain the reason, and provide no further information. The Department of Interior's regulation of offshore oil drilling safety provides one example of this: after concluding that it could not estimate the marginal safety benefit of the regulation, the agency did not provide an estimate of the benefit of preventing such a spill.[104]

The efforts by various agencies to regulate the emission of mercury and mercury compounds are similarly illustrative. In 2011, the Department of Energy promulgated a trio of regulations setting energy efficiency standards for air conditioners, furnaces, refrigerators, clothes dryers, and other home appliances.[105] Higher-efficiency appliances use less energy and reduce the burning of fossil fuels needed to produce that energy. The agency's cost-benefit analysis thus includes reductions in pollution due to electrical power generation. These pollutants include carbon dioxide, nitrogen oxides, and mercury. The DOE calculated the monetary value of the reduction in carbon dioxide and nitrogen oxide emissions, but it could not calculate the monetary value of the reduction in mercury emissions.[106] The DOE was able to estimate the reduction in emissions—for instance, the regulation governing

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103 There is no indication why the agency did not try. As of February 2013, the costs to BP from its catastrophic oil spill totaled $42.2 billion. *See* Agustino Fontevecchia, *BP Fighting a Two Front War as Macondo Continues to Bite and Production Drops*, FORBES (Feb. 5, 2013, 11:57 AM), http://www.forbes.com/sites/afontevecchia/2013/02/05/bp-fighting-a-two-front-war-as-macondo-continues-to-bite-and-production-drops/#55016e602b87 [https://perma.cc/2XAN-5UMP]. Because BP was being forced to internalize the costs of the spill to the extent possible, this seems a reasonable estimate of the total economic impact of the event.

104 *See* BUREAU OF OCEAN ENERGY MGMT., *supra* note 101, at 19.

105 *See generally* Energy Conservation Program: Energy Conservation Standards for Residential Furnaces and Residential Central Air Conditioners and Heat Pumps, 76 Fed. Reg. 67037, 67037 (Oct. 31, 2011) (codified at 10 C.F.R pt. 430); Energy Conservation Program: Energy Conservation Standards for Residential Refrigerators, Refrigerator-Freezers, and Freezers, 76 Fed. Reg. 57516, 57516 (Sept. 15, 2011) (codified at 10 C.F.R. pt. 430); Energy Conservation Program: Energy Conservation Standards for Residential Clothes Dryers and Room Air Conditioners, 76 Fed. Reg. 22454, 22454 (Apr. 21, 2011) (codified at 10 C.F.R. pt. 430).

106 DEP'T OF ENERGY, TECHNICAL SUPPORT DOCUMENT FOR THE FINAL RULE ON RESIDENTIAL REFRIGERATORS, REFRIGERATOR-FREEZERS AND FREEZERS 1–2 tbl.1.2.1, 2-

clothes dryers and air conditioners would reduce mercury emissions by 0.073 tons.[107] However, it provided no information beyond that figure. The DOE explained in a footnote that it was "aware of multiple agency efforts to determine the appropriate range of values used in evaluating the potential economic benefits of reduced Hg emissions."[108] However, it had "decided to await further guidance regarding consistent valuation and reporting of Hg emissions before it once again monetizes Hg emissions reductions in its rulemakings."[109] The Department of Energy did not provide any preliminary results from these studies; it did not offer a guess or a rough estimate as to the eventual outcome of these studies; and it did not even name the agencies involved in these efforts to quantify mercury benefits.

The following year, the EPA promulgated the mercury regulation we described in the introduction.[110] This regulation was directed at mercury emissions in particular. By this point, the EPA had assembled some data on the benefits of limiting mercury emissions, but those data were very sparse. The EPA had estimated only the neurologic benefits (avoiding loss of IQ) to children who were exposed to mercury through "recreationally caught freshwater fish."[111] The EPA could not quantify other neurologic effects (effects on memory, for instance); other non-neurologic health effects such as improved cardiovascular health; decreased mortality from mercury toxicity; or even benefits to children who were exposed to mercury through channels other than recreationally caught freshwater fish.[112] It also did not estimate the monetary value of environmental benefits that did not directly impact human life or health.[113] Like the DOE regulations from the previous year, the EPA did not venture any guesses—or offer any

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15 (2011), http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/refrig_finalrule_tsd.pdf [https://perma.cc/W5LE-XW6G].

107 Energy Conservation Program: Energy Conservation Standards for Residential Clothes Dryers and Room Air Conditioners, 76 Fed. Reg. at 22457.

108 *Id.* at 22457 n.3.

109 *Id.*

110 *See generally* National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9304, 9304 (Feb. 16, 2012) (codified at 40 C.F.R. pts. 60 & 63).

111 EPA, *supra* note 3, at ES–1, ES–11 tbl.ES–5.

112 *Id.* at ES–11 tbl.ES–5.

113 *Id.* at ES–12 tbl.ES–6.

additional information—regarding the benefits that were not fully quantified.[114]

The third pattern that emerges from the regulations is that agencies often justify their failure to quantify benefits based on lack of data even though agencies could fund studies to collect that data. One example is a 2013 Health and Human Services (HHS) regulation on the labeling of gluten-free foods.[115] The primary benefit of the regulation was that it would aid people with celiac disease in selecting and consuming gluten-free foods. However, the agency was not able to fully quantify the benefits of the regulation—and there was significant uncertainty surrounding the benefits it did quantify—because it had no data on what fraction of food eaten by a typical person with celiac disease is labeled as gluten-free. (If the consumer does not pay attention to the label, the regulation is irrelevant.) If the typical consumer eats a high proportion of foods labeled gluten-free, the regulation—which would clarify and enforce those standards—might have significant benefits. If consumers eat only a small fraction of such foods, the regulation would produce only meager benefits. HHS explained that it could only guess at this number because no studies existed. But the agency could have conducted its own survey of consumer behavior, and in fact the agency had conducted many other similar surveys of related consumer behavior for this and other regulations.

Another example is a 2013 regulation by the Department of Homeland Security (DHS) governing the rules that individuals

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114 EPA's treatment of mercury's benefits has become a major legal issue for the agency. A number of state and private petitioners have challenged the EPA's rule, arguing that the agency should have considered that the rule's costs dramatically outweigh its benefits. *See* Michigan v. EPA, 135 S. Ct. 2699, 2702–06 (2015). EPA estimated that the annual costs of the rule would be $9.6 billion and the benefits of mercury reduction would be only about $0.005 billion. *See* EPA, *supra* note 3, at ES–1. The EPA estimated that the rule would produce approximately $37 to $90 billion in total benefits, the vast majority of which were attributable to reductions in particulate matter emissions. *See id.* But because the rule is targeted at mercury emissions in particular, petitioners have argued that the benefit-cost ratio for mercury is of special importance. *See* Brief for Petitioners State of Michigan, et al. at 47–48, Michigan vs. EPA, 135 S. Ct. 2699 (2015) (Nos. 14–46. 14-47, 14-49).

115 *See generally* Food Labeling; Gluten-Free Labeling of Foods, 78 Fed. Reg. 47154, 47154 (Aug. 5, 2013) (codified at 21 C.F.R. pt. 101); FDA, FDA-2005-N-0404 FOOD LABELING; GLUTEN-FREE LABELING OF FOODS: FINAL REGULATORY IMPACT ANALYSIS 15-18 (2013), http://www.fda.gov/downloads/AboutFDA/ReportsManualsForms/Reports/EconomicAnalyses/UCM363530.pdf [https://perma.cc/C64M-F53Z].

must follow when obtaining a visa.[116] Prior to this regulation, noncitizens living in the United States were obligated to leave the United States while waiting for their visas to be processed or renewed. The DHS regulation changed the rule to allow noncitizens to remain in the country pending the processing of their visas, so long as the noncitizen was living with immediate relatives who were themselves American citizens. The regulation's benefit was in avoiding the disruption—emotional and financial—to the visa applicant's U.S. relatives if the applicant was forced to live abroad while waiting for her visa. However, the agency claimed that it could not quantify this benefit because it was "currently unable to estimate the average duration of time an immediate relative must spend abroad while awaiting waiver adjudication under the current process."[117] This strikes us as implausible; does DHS not keep statistics on its average visa processing time? And even if such statistics were not available, couldn't the agency have conducted a short survey to determine the average wait time?

Finally, there were a number of regulations in which the agency calculated the number of lives the regulation would save but could not quantify the regulation's morbidity benefits—the value of avoiding nonfatal diseases and other medical conditions.[118] This continues a trend we observed in prior work.[119] There, we found that agencies—including the EPA and the Occupational Safety and Health Administration (OSHA)—regularly claim to be unable to quantify nonfatal regulatory health benefits such as prevented cases of bronchitis, emphysema, and asthma. It is strange that agencies attach valuations to loss of life but not to illness, especially given that studies quantifying the costs of nonfatal diseases and health conditions certainly exist.[120] If agencies

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116 *See generally* Provisional Unlawful Presence Waivers of Inadmissibility for Certain Immediate Relatives, 78 Fed. Reg. 536, 536 (Jan. 3, 2013) (codified at 8 C.F.R. pts. 103 & 212).

117 *Id.* at 574.

118 *See, e.g.*, Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers, 77 Fed. Reg. 32308, 32310 (May 31, 2012) (codified at 10 C.F.R. pts. 429 & 430) (calculating benefits from reduced pollution-related deaths because of greater energy efficiency but ignoring morbidity benefits).

119 Jonathan S. Masur & Eric A. Posner, *Against Feasibility Analysis*, 77 U. CHI. L. REV. 657, 701 (2010).

120 *See, e.g.*, Nattavudh Powdthavee & Bernard van den Berg, *Putting Different Price Tags on the Same Health Condition: Re-evaluating the Well-Being Valuation Approach*, 30 J. HEALTH ECON. 1032, 1038 tbl.3 (2011) (monetizing the value of avoiding nonfatal health issues).

have some reason for ignoring these studies or distrusting their findings, they have not revealed it.

C. Agency-by-Agency Data

Our data also reveal significant differences between agencies in the extent to which they quantify benefits and costs. Seven different agencies are responsible for the fifty regulations promulgated between 2010 and 2013 in which the agency was able to fully or partially quantify both costs and benefits. However, the agencies differ widely in their contributions to this total. The EPA (thirteen regulations), DOE (ten regulations), and Department of Transportation (thirteen regulations, including three issued jointly with the EPA) together account for thirty-five of the fifty regulations (70%) in our data. By contrast, there were twelve agencies that produced at least one regulation among the fifty-six regulations in which either benefits or costs (or both) were not quantified at all. Here too our data are dominated by a few agencies. The Department of Health and Human Services produced twenty-two regulations in which either costs or benefits were quantified, including six that were promulgated jointly with the Department of Labor. The Department of the Interior was responsible for ten more, and in combination the two agencies represent thirty-two of the fifty-six regulations (57%) in our data.

In Table 3 below, we categorize each rule by the agency promulgating the rule and the extent to which the agency quantified the benefits and costs involved.

What accounts for the broad discrepancies in agency-by-agency practices? In part they are an artifact of the types of regulations the agencies are promulgating and the statutes under which the agencies are operating. For instance, the Department of Health and Human Services issued a number of regulations implementing the Affordable Care Act, and as we noted above, the costs and benefits of such regulations are difficult or impossible to calculate separate from the statutes themselves. Similarly, as we explained above, several of the Department of Labor's regulations implement employment antidiscrimination rules (as does the EEOC's lone regulation), and these regulations produce dignity- and equity-related benefits that agencies refuse to quantify.

In other cases, however, there appear to be significant differences among agencies in their facility with cost-benefit analysis and access to data and modeling. For instance, the Department of Energy, Department of Transportation, and EPA

TABLE 3. REGULATIONS BY AGENCY AND DEGREE OF QUANTIFICATION.

	Number of Regulations				
Agency	**Fully quantified benefits and costs**	**Partially quantified benefits and costs**	**No quantified benefits**	**No quantified costs**	**No quantified benefits or costs**
Agriculture			4		
Education			2		
EEOC			1		
Energy		10			
EPA		13	3		3
EPA & Transportation		3			
Health and Human Services	1	5	11		5
HHS, Labor, and Treasury			5		1
Homeland Security		1	1		
Housing and Urban Development			1		
Interior			2	8	
Justice		3	1		
Labor		4	4		
Office of Personnel Management					1
Transportation	1	9			
Treasury			1	1	1
Total:	2	48	36	9	11

have long employed cost-benefit analysis and have accumulated a significant quantity of data (and developed a broad set of useful models). In particular, regulations that affect the burning of fossil fuels draw on numerous existing studies.[121]

Other agencies, by contrast, appear to be novices to cost-benefit analysis. The Department of Agriculture promulgated four regulations in our sample and quantified benefits for none of them. The benefits from these regulations are not obscure, either. Two of the regulations set school lunch nutrition stan-

121 *See, e.g.*, Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers, 77 Fed. Reg. at 32353–57 (describing extensive EPA and DOE research on harm from emissions).

dards and were expected to provide benefits by improving children's health.[122] Another regulation mandated country-of-origin labeling on food, which would provide consumers with additional purchasing information.[123] Not only do the benefits of such labels seem quantifiable, there are existing studies assessing U.S. consumer willingness to pay for country-of-origin labels.[124] The fourth regulation was directed internally, at the U.S. Farm Service Agency, and relaxed the terms under which that subagency is required to purchase sugar from U.S. farmers.[125] The regulation is expected to produce cost savings both for the federal government and for biofuel producers. Despite the fact that these benefits would seem straightforward to quantify, the agency refused to put a number on them.

The lagging agencies should adopt the cost-benefit practices of the leading agencies. OIRA is ideally positioned to perform this type of centralizing function and educate agencies in the practice of CBA.[126] The economists at OIRA could also aid agencies in gathering and analyzing the data necessary for CBA where those data do not already exist.

D. Unquantified Costs

To this point we have focused on unquantified regulatory benefits. Unquantified costs call for separate treatment. As Table 1 indicates, there are only nine regulations in our data in which an agency quantified some benefits but entirely failed to quantify costs, in comparison to thirty-six regulations in which an agency quantified costs but not benefits. (There were eleven

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122 *See* National School Lunch Program and School Breakfast Program: Nutrition Standards for All Foods Sold in School as Required by the Healthy, Hunger-Free Kids Act of 2010, 78 Fed. Reg. 39068, 39068 (June 28, 2013) (codified at 7 C.F.R. pts. 210 & 220); Nutrition Standards in the National School Lunch and School Breakfast Programs, 77 Fed. Reg. 4088, 4088 (Jan. 26, 2012) (codified at 7 C.F.R. pts. 210 & 220).

123 *See* Mandatory Country of Origin Labeling of Beef, Pork, Lamb, Chicken, Goat Meat, Wild and Farm-Raised Fish and Shellfish, Perishable Agricultural Commodities, Peanuts, Pecans, Ginseng, and Macadamia Nuts, 78 Fed. Reg. 31367, 31367 (May 24, 2013) (codified at 7 C.F.R. pts. 60 & 65).

124 *See* Wendy J. Umberger, *Will Consumers Pay a Premium for Country-of-Origin Labeled Meat?*, CHOICES (2004), http://www.choicesmagazine.org/2004-4/cool/2004-4-04.htm [https://perma.cc/ZAQ7-8TSL].

125 *See generally* Sugar Program; Feedstock Flexibility Program for Bioenergy Producers, 78 Fed. Reg. 45441, 45441, 45445 (July 29, 2013) (codified at 7 C.F.R. pt. 1435).

126 The Office of Information and Regulatory Affairs (OIRA) is the federal government's central authority for reviewing executive branch regulations. *See* Exec. Order No. 13,563, 3 C.F.R. 215 (2012), *reprinted in* 5 U.S.C. § 601 app. at 102-03 (2012); Exec. Order No. 12,866, 3 C.F.R. 638 (1994), *reprinted as amended in* 5 U.S.C. § 601 app. at 88–92 (2012).

regulations in which an agency did not quantify either.) Of the forty-eight regulations in which an agency partially quantified both benefits and costs—meaning that it assigned a nonzero number to each—the agency left some costs unquantified in twenty-eight cases.

Yet few regulations in our dataset involved unquantified costs of any great magnitude. In part this is because costs are typically easier to measure than benefits—if a factory must install some new type of pollution-reducing scrubber, the agency can simply compute the cost of installing the scrubber. Costs often take the form of goods that are priced on markets, while benefits often do not.[127] In addition, regulated entities themselves are often the source for information regarding regulatory costs, and they have incentives to produce information about those costs.[128] If an agency fails to quantify a cost, and a regulated entity submits a comment supplying an estimate of that cost (and arguing that the regulation is not cost-benefit justified), the regulation is not likely to survive judicial review if the agency fails to take the cost into account.[129] In the majority of cases, the unquantified costs were the administrative costs of implementing or adhering to some new regulatory scheme—and often these administrative costs would be borne by the agency itself. These costs are surely nonzero, but we suspect that they are unlikely to fall within an order of magnitude of the other economic effects of the regulation. (Recall that we are only analyzing "significant" regulations with economic impacts of $100 million or more.) Nonetheless, it is surprising that so many agencies in our data failed to quantify administrative costs, given that agencies are no strangers to quantifying the costs of administrative paperwork and have done so many times.[130]

The other unquantified costs are a hodgepodge of relatively small-ticket items. For instance, two 2013 Department of the Interior regulations governing migratory bird hunting listed

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127 Of course, this is partly because agencies do not count unemployment as a regulatory cost. We have argued elsewhere that they should do so. *See* Jonathan S. Masur & Eric A. Posner, *Regulation, Unemployment, and Cost-Benefit Analysis*, 98 VA. L. REV. 579, 580 (2012).

128 *See* Frank Ackerman & Lisa Heinzerling, *Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection*, 150 U. PA. L. REV. 1553, 1580 (2002).

129 The regulation could conceivably be struck down on two separate grounds: as arbitrary and capricious under 5 U.S.C. § 706 (2012) and for failing to respond to a comment under United States v. Nova Scotia Food Prods. Corp., 568 F.2d 240, 251–53 (2d Cir. 1977).

130 *See* Adam M. Samaha, *Death and Paperwork Reduction*, 65 DUKE L.J. 279, 296–300 (2015).

lost state revenue from "lost . . . hunter expenditures" as the primary unquantified costs.[131] The EEOC regulation implementing aspects of the Americans with Disabilities Act, which we discussed earlier, names the possibility of increased litigation—to enforce the terms of the regulation—as a possible unquantified cost.[132] We also previously described the Treasury regulation requiring direct deposit, which would impose emotional costs on federal benefits recipients who are adverse to direct deposit.[133] The EPA lists some employment costs among the unquantified costs of a 2011 Cross-State Air Pollution Rule.[134] We have argued elsewhere that agencies should take unemployment costs into account when performing cost-benefit analysis,[135] though even significant unemployment effects would not likely put a dent in this particular rule—the EPA projected $120 to $280 billion in annual benefits and only about $800 million in annual costs.[136] Finally, at least one regulation includes unquantified costs that may actually be benefits. In 2010, the Department of Labor promulgated a regulation mandating greater disclosure of pension plan fees to participants in the plan.[137] The DOL stated that it could not quantify the costs that would accrue if some employers responded to the regulation by declining to offer pension plans. If employers drop their pension plans because of the administrative burden imposed by the regulation, then that is truly a cost. But if a plan is dropped because participation falls once em-

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131 FISH & WILDLIFE SERV., FWS-HQ-MB-2013-0057-0424, ECONOMIC ANALYSIS OF THE MIGRATORY BIRD HUNTING REGULATIONS FOR THE 2013-2014 SEASON 10 (2013), https://www.regulations.gov/document?D=FWS-HQ-MB-2013-0057-0424 [https://perma.cc/8SFZ-T43R]; *see generally* Late Seasons and Bag and Possession Limits for Certain Migratory Game Birds, 78 Fed. Reg. 58204, 58204 (Sept. 23, 2013) (codified at 50 C.F.R. pt. 20); Migratory Bird Hunting; Early Seasons and Bag and Possession Limits for Certain Migratory Game Birds in the Contiguous United States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands, 78 Fed. Reg. 53200, 53200 (Aug. 28, 2013) (codified at 50 C.F.R. pt. 20).

132 *See* Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act, as Amended, 76 Fed. Reg. 16978, 16995 (Mar. 25, 2011) (codified at 29 C.F.R. pt. 1630).

133 Management of Federal Agency Disbursements, 75 Fed. Reg. 80315, 80330 (Dec. 22, 2010) (codified at 31 C.F.R. pt. 208).

134 *See* Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48208, 48317–19 (Aug. 8, 2011) (codified at 40 C.F.R. pts. 51, 52, 72, 78, & 97).

135 Masur & Posner, *supra* note 127, at 580.

136 Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. at 48318.

137 Fiduciary Requirements for Disclosure in Participant-Directed Individual Account Plans, 75 Fed. Reg. 64910, 64933 (October 20, 2010).

ployees realize the fees they are being asked to pay, then this may represent a social benefit instead.

In the end, we cannot know whether agencies have hidden major costs under the heading of "unquantified" or even failed to name them at all. After all, if a regulation causes unemployment, it is possible that it harms people's dignity and produces negative distributive effects. If these effects should be taken into account as arguments for regulation, they should be taken into account as arguments against regulation as well. But our regulatory survey has failed to unearth promising candidates. Given the often adversarial backdrop to agency rulemaking, this does not come as a significant surprise. If agencies are erring by omission and using the lack of quantification to advance suspect regulation, it is more likely to be occurring on the benefits side.

Further, it is important to note that we are able to observe only those regulations that agencies have decided to promulgate, not proposed or contemplated regulations that were rejected. There may be many instances in which an agency does not proceed with a regulation because it has not bothered to calculate all of the benefits that regulation will provide. Indeed, Victor Gilinsky, a former commissioner of the Nuclear Regulatory Commission (NRC), explained to us that the NRC was previously thought to "stack the deck" against regulation by refusing to quantify benefits other than effects on human health.[138] We cannot verify this statement, and we cannot observe agency actions that do not occur. Nevertheless, it is likely that the failure to quantify benefits frequently results in underregulation.

III
UPDATING COST-BENEFIT ANALYSIS

An argument can be made that regulators do not use cost-benefit analysis properly because they rely heavily on unquantified benefits in order to justify regulations. As we discussed in Part II, it is possible that regulators claim unquantified benefits in order to rationalize bad regulations that they seek to issue for ideological or political reasons. However, it is also possible that their behavior is, at least roughly, normatively defensible. We sketch below this normative argument and

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138 Victor Gilinsky, Former Comm'r of the Nuclear Regulatory Comm'n, University of Chicago Conference on Federal Agency Decision Making Under Deep Uncertainty (May 8, 2015) (notes on file with author).

show that if it is correct, it nonetheless requires significant reform of agency practice.

A. Static Versus Dynamic Cost-Benefit Analysis

Imagine that a factory begins to use substance *X* in its production process, as a result of which workers are exposed to a small quantity of it. Substance *X* is known to produce cancer in rats that are forced to consume vast amounts of it. There is also anecdotal evidence that some human beings who have been exposed to *X* later developed cancer, although it is not known whether the exposure caused the cancer. No epidemiological studies of *X* have been performed, in part because until now *X* has rarely been used in manufacturing or any other common process. Some workers in the factory complain that they have suffered headaches ever since *X* was introduced.

A staff member at OSHA recommends that all factories that use *X* be required to supply ventilation masks to their workers, which would cost $1 million. An economist at OIRA argues that such a regulation would fail a cost-benefit analysis because the benefits of the regulation are $0.

We regard such an argument as naïve because it ignores information about the lab rats, the anecdotes, and the worker complaints. More precisely, it ignores the "prior" of the staff member. Inspired by Bayes' Rule, we argue that this is the wrong approach.[139] Imagine that the staff member has worked at OSHA for decades and over the years has developed an intuitive sense of when chemical substances are dangerous and when they are not. Perhaps the staff member has learned from experience that substances frequently thought to be safe have turned out to be dangerous. Or perhaps she recognizes that substances with certain telltale characteristics often turn out to be dangerous, and *X* shares those characteristics. The staff member may not even be able to articulate her reasons for believing that *X* is dangerous, but nonetheless she believes that it is (though she is not certain).

The staff member has what is known in Bayesian statistics as a "prior"—an estimate as to the value of some unknown

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139 Bayes' Rule is a formula for updating the probability of an event as new information becomes available about it. In practice, Bayesian reasoning assumes that probability estimates may be based on the personal experience and knowledge of individuals rather than derived from statistical analysis of a large sample of events. *See* Jeff Strnad, *Should Legal Empiricists Go Bayesian?*, 9 AM. L. ECON. REV. 195, 288–92 (2007). This estimate is used as a starting point and updated as new information arises.

number.[140] This prior is more than just a random guess. It is the product of the regulator's experience and intuition, which provides useful information. The OIRA economist may be right that the regulation should not be issued, but she is wrong to claim that the benefits of the regulation are $0. If the regulator's beliefs are sincere, the benefit of the regulation is likely greater than $0. The problem is that the regulator has not articulated her assumptions. If the regulator does not make her assumptions explicit, they cannot be tested or updated.

Let us suppose that we force to her to. Imagine that the regulator finally says that she believes that 100 workers will be exposed to the chemical over a certain period of time. She thinks there is a 1% probability that a worker will develop cancer and die. She also believes that on average half of the workers will develop ten headaches per year as a result of exposure. After some further thought, she thinks that the workers would be willing to pay $20 to avoid the headaches. Accordingly, she calculates the benefit of the regulation as $6,010,000, assuming a valuation of statistical life of $6 million and ignoring discounting. Based on this calculation, the regulation passes a cost-benefit analysis.

Is the number spurious and no better than any other? We do not think so—the number is the product of the regulator's latent knowledge and expertise. Moreover, the mandate to estimate numbers—even if they are little more than guesses—has important institutional value because the numbers provide a basis for evaluating the regulators' reliability as additional information is disclosed later on. In addition, the numbers also provide a basis for revisions in light of additional information. Once a regulatory agency has relied upon a prior, the agency should update that prior in light of new information. The updated estimates would then be used in future regulations or even to revise the original regulation. The crucial difference from current practice is that agencies would no longer price benefits and harms at $0 when they lacked complete statistical information. They would offer their best estimates, act on those estimates, and then update the estimates over time. We will discuss the process of updating in greater detail below.

Naïveté can go in the other direction as well. Imagine that the factory decides to use substance *Y* instead. Substance *Y* is widely believed to be completely harmless. But one day a respected epidemiologist publishes a study that finds that *Y* is

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140 *See id.* at 198–99 (describing and explaining Bayesian statistics).

associated with a dangerous form of cancer. The relationship between *Y* and cancer is statistically significant at the five percent level. The economist at OSHA accordingly recommends that the agency issue a regulation that limits exposure of workers to *Y*. However, such a cost-benefit analysis would be naïve. The reason is that if the OSHA staffer has a strong prior that *Y* is harmless, then there is a reasonable chance that the relationship found in the study is spurious. After all, one out of twenty such studies will be wrong; there is also reason to believe that scientists are biased toward publishing studies with statistically significant results.[141] If the staffer has a strong enough prior that *Y* is harmless, then it may be reasonable to believe that this particular study is one of the wrong ones.

Naïveté can also affect the cost side. Environmentalists have complained that when regulators conduct cost-benefit analyses, they typically rely on industry data in order to determine costs.[142] Industry data is backward-looking and so does not take into account that the cost of complying with a regulation—buying and installing scrubbers, for example—is likely to decline in the future. The producers of scrubbers may benefit from economies of scale or technological development as they respond to increased demand driven by regulatory requirements. With this information, regulators should apply a discount to cost estimates derived from industry data.

We can summarize these comments by distinguishing between cost-benefit analysis as a procedure and cost-benefit analysis' inputs. As a procedure, cost-benefit analysis merely directs regulators to issue regulations if the benefits exceed the costs. The procedure itself does not direct regulators to use only certain types of informational inputs such as peer-reviewed studies. Regulators should use all relevant informational inputs when they conduct cost-benefit analyses, subject to some qualifications that we discuss below. This means that the regulator's prior should be used rather than disregarded. The process of repeatedly updating the prior in light of new information has a dynamic or Bayesian quality that distinguishes it from cost-benefit analysis as traditionally understood.

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141 *See* Alan S. Gerber, Donald P. Green & David Nickerson, *Testing for Publication Bias in Political Science*, 9 POL. ANALYSIS 385, 385, 391 (2001) (explaining that there is a bias against statistically insignificant studies in political science and bias against statistically insignificant studies is well documented in psychology, medical science, and economics).

142 *See* Ackerman & Heinzerling, *supra* note 128, at 1580.

B. Responses

We can imagine a number of responses to our argument. The first is that the regulator's prior is arbitrary; it has no basis in fact. If the prior is arbitrary, then it should not be used, and instead the regulator should assume that any possible effect that cannot be verified by scientific studies has a probability of zero.[143]

The problem with this argument is that the zero probability is even more arbitrary than the regulator's prior. Consider the risk that the commercialization of drones would cause harm because some people would use drones to spy on strangers in their homes.[144] The risk of this harm clearly cannot be established with a scientific study. We do not know how often drones would be used in this way; and we do not know how to monetize the privacy invasion. Yet it is clear that the risk and the harm are greater than zero. Accordingly, the regulator's prior would be greater than zero and it would be arbitrary and wrong to treat the expected harm as zero. The regulator should be forced to quantify the expected harm with the understanding that a very wide range of valuations would be reasonable.

Second, one could argue that there are tiny risks on both sides of the cost-benefit analysis, and so it is reasonable to treat them as offsetting. In the case of drones, for example, people who use drones might, while spying on strangers, discover someone who is having a heart attack and call an ambulance, saving that person's life. The tiny probability of this benefit offsets the tiny probability of harm from spying, and thus we should just treat both probabilities as zero.

This argument is also wrong. If both probabilities are very low, then they will not affect the cost-benefit analysis, and in that sense the critic is right that it would be harmless to treat both probabilities as zero. But there is independent value in forcing the regulator to make explicit her assumptions. After the regulation has been in place for a while, we will learn whether the regulator's priors were accurate or not. That provides important information about the reliability of the regulator. In addition, the prior will continue to play a role as the regulator determines posterior probabilities in the light of new information. If the regulator is able to collect information about ambulance calling but not about spying, then the regula-

143 *See* Hahn, *supra* note 55, at 1037–38.

144 *See* Nicholas Ryan Turza, *Dr. Dronelove: How We Should All Learn to Stop Worrying and Love Commercial Drones*, 15 N.C. J.L. & TECH. ON. 319, 360 (2014).

tor will be able to update its probability estimates about ambulance calling, but it should maintain its prior about spying.

A third worry is that if regulators are allowed to rely on their subjective priors, then they will be able to rationalize regulations that they seek to implement for improper reasons. Imagine that the head of the EPA holds a much more extreme view of environmental protection than could be justified by statutory law or public opinion. Or consider the possibility that the head of OSHA might try to limit workplace protections in order to cultivate relationships with political allies in the business world. The EPA might choose to value headaches at $100 or $1000 rather than $20, while OSHA might value them at $1 or 1 cent. In this way, the agencies could engineer cost-benefit analyses that rationalize regulations chosen for other reasons.

While this concern is a legitimate one, the proper response is not to ban regulators from relying on their priors or to force them to assign zero value to hard-to-quantify benefits or costs. Such a ban would make no sense: people cannot avoid relying on their priors. As we argue below, when courts or OIRA have a good reason for believing that an agency is biased, then they should be skeptical of the agency's work product—all of the work product, not just the unquantified benefits. But often they will not have such a reason.

A fourth concern is that if agencies can justify a regulation on the basis of unquantified benefits, then regulators will be lazy.[145] It is nearly always the case that when a regulation is first considered, the potential benefits are not yet quantified. The regulator must decide whether to commission studies to quantify those benefits or not. A budget-constrained regulator may be tempted to claim that some benefits are unquantifiable to avoid having to fund a study. But if regulators were allowed to do this, then frequently regulations would be approved that are not cost-justified.

However, banning regulators from relying on unquantified benefits is too extreme a response to this problem. Instead, OIRA, courts, and other reviewers should demand a good explanation for why benefits are unquantifiable. And when regulators articulate their priors by stating their assumptions, this will impose self-discipline on them and make it difficult to exaggerate the costs of doing additional studies.

Finally, in a recent paper addressing the problem of regulation in the face of uncertainty, Cass Sunstein advocates what

145 *See* Hahn, *supra* note 55, at 1037–38.

he calls "breakeven analysis," a practice that is also recommended by OMB.[146] As OMB puts it, when an agency faces uncertainty, it should ask itself, "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?"[147] However, OMB's proposal is puzzling. It does not tell the agency how the answer to that question should guide it. Indeed, in the same paragraph OMB tells agencies to use their "professional judgment in determining how important the non-quantified benefits or costs may be in the context of the overall analysis."[148]

Sunstein provides a number of examples that might indicate what OMB means. In one example, a clean-water regulation will cost $200 million but the benefits cannot be specified. Sunstein says that under breakeven analysis, the agency should ask how many water bodies will be affected, how they would be improved, how people would be helped, and other related questions. He then suggests that, for example, if only twenty small water bodies are affected by the regulation, and these water bodies are rarely used by people, then the regulation would fail breakeven analysis. The breakeven analysis indicates that there must be at least $10 million of benefits for each water body for the regulation to generate positive net benefits. That may seem implausible. But if there are 200,000 water bodies and they are frequently used by people, then the regulation might pass breakeven analysis.[149]

As we interpret it, breakeven analysis is in some respects consistent with the approach we recommend. Breakeven analysis requires that agencies quantify as much as they can and then make a reasonable judgment based on the quantification. We agree with this argument as far as it goes. But that reasonable judgment must be based upon some intuition, prior probability, or best guess. Agencies should do more than just pronounce judgment: they should make explicit the institution or prior that underlies the judgment and describe it with as much specificity as possible. That is, agencies should make specific "point" estimates of the benefits and costs of the regulation. In the example above, the agency should not only identify the number of water bodies and the number of people who

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146 Sunstein, *supra* note 32, at 1372; *see* OFFICE OF MGMT. & BUDGET, *supra* note 9, at 2.

147 OFFICE OF MGMT. & BUDGET, *supra* note 9, at 2

148 *Id.*

149 Sunstein, *supra* note 32, at 1387–88.

use them but also estimate the monetized benefit to the people who use those bodies based on how they use them (for recreation, for potable water, for industrial use, etc.). After all, the agency *must* be doing this implicitly when it decides whether or not to promulgate the regulation. The agency should be forced to make that implicit judgment explicit so that it can be evaluated and studied. Further analysis may reveal that, in fact, the people who use the twenty small water bodies are greatly benefited by the clean water, while the people who use the 200,000 water bodies are hardly benefited at all. If so, the agency's initial judgment was mistaken.

Our argument—and here we disagree with Sunstein—is that quantification of all relevant costs and benefits is necessary, even those that people insist are "unquantifiable," and therefore the exercise of calculating the minimum benefits necessary for the regulation to create zero net benefits is idle. If uncertainty seems overwhelming, agencies should nonetheless provide a point estimate, along with information about their confidence level. They should also indicate how further information gathering about the impact of the regulation itself on people's well-being after it has been issued will help reduce uncertainty so that the regulation can be revised in the future.

C. Institutional Responses to Regulatory Uncertainty

If our argument is correct, then the regulatory system should not avoid using priors but instead should *institutionalize* them. By this we mean that agencies should be permitted to rely on priors, but processes should be in place to ensure that agencies do not abuse their power to do so. We suggest the following reforms.

First, while agencies should be permitted to rely on priors, they should also be forced to articulate them. Accordingly, agencies should *not* be permitted to justify a regulation that otherwise fails a (quantified) cost-benefit analysis by appealing to "unquantified benefits." Instead, agencies should identify the unquantified benefits and then publish an estimate of what they are. For example, if agencies believe that emission of a chemical substance will cause headaches, they should publish estimates of the population exposed to the chemical substance, the fraction they believe to be susceptible to headaches, and a valuation for an avoided headache. The agency should be allowed to rely on pure guesswork or intuition except to the extent that some elements of this calculation (such as the population that is exposed) can be verified empirically. The

agency must be clear that it is guessing—that is, relying on a prior.

Second, agencies should be required to provide an institutional mechanism for updating their priors. One such mechanism would be a requirement in the regulation itself that the regulator revisit its assumptions about unquantified benefits in the future—say, in one year or five years. The agency would further be required to publish a statement in which it confirms or modifies the assumptions behind the prior. The agency will be permitted to update the prior as long as it provides reasons. If the regulation appears not to be cost-benefit justified after the regulator has updated its priors, then the regulation should be repealed or amended in such a way that it satisfies a cost-benefit test. Alternatively, agencies could put in place mechanisms for reviewing the priors for all regulations rather than provide for such mechanisms in each regulation. This review of priors could take place as part of the broader retrospective review of regulations implemented by the Obama Administration.[150]

Third, from time to time OIRA should evaluate the accuracy of the priors used by agencies in their regulations. If priors are frequently revised, this is evidence that the agency does not have very good intuitions about the hard-to-quantify benefits of regulations within its expertise or that regulators act in a political or ideological fashion (especially if the revisions occur across administrations). OIRA might give less deference to the priors of agencies that frequently revise them.

Fourth, OIRA should also examine cases where different agencies give different valuations to the same types of benefits. Suppose that the EPA and OSHA offer different valuations for avoided headaches, based on their priors. OIRA might then

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150 *See* Exec. Order No. 13,610, 3 C.F.R. § 258, 258 (2013), *reprinted in* 5 U.S.C. § 601 app. at 106–07 (2012) ("[I]t is particularly important for agencies to conduct retrospective analyses of existing rules to examine whether they remain justified and whether they should be modified or streamlined in light of changed circumstances . . . ."); Exec. Order No. 13,563, 3 C.F.R. § 215, 217 (2012), *reprinted in* 5 U.S.C. § 601 app. at 102–03 (2012) ("To facilitate the periodic review of existing significant regulations, agencies shall consider how best to promote retrospective analysis of rules that may be outmoded, ineffective, insufficient, or excessively burdensome . . . ."); ADMIN. CONFERENCE OF THE U.S., ADMINISTRATIVE CONFERENCE RECOMMENDATION 2014-5: RETROSPECTIVE REVIEW OF AGENCY RULES 1 (2014), https://www.acus.gov/sites/default/files/documents/Recommendation%25202014-5%2520%2528Retrospective%2520Review%2529_1.pdf [https://perma.cc/MEP8-9VYH] (recommending retrospective review); *Retrospective Review of Regulations*, OFFICE OF MGMT. & BUDGET, https://www.whitehouse.gov/omb/oira/regulation-reform [https://perma.cc/9MTS-7R84] (describing Obama administration efforts to review regulations).

convene an interagency group to conduct empirical analysis and resolve the inconsistency.[151]

To illustrate the effects of this reform, let us consider again the school lunch regulation. Recall that the regulator disclosed the costs of the regulation but said that the benefits—improved nutrition for schoolchildren—were unquantifiable.[152] Under our approach, the regulator would be required to provide estimates (in some cases, guesses) of the following numbers: (1) the number of children who would consume this new lunch, taking into the account that some children might throw out a lunch that does not taste good; (2) the nutritional effect of the new lunch, taking into account that this may vary across body types, demographic groups, and so on, meaning that the regulator would also need to rely on demographic and related information if it is available, and to make guesses if not; (3) the health effect of the improved nutrition, again taking into account differences across body types, demographic groups, and so on; and (4) the monetary value of the health effect.

It is important to observe that the calculation of the lunch regulation's benefits would be based on a range of types of information—some of it easily quantified, others of it not. For example, the regulator will be able to start with basic demographic information that is probably already in its possession or is otherwise easily available. However, the regulator will only be able to guess about the effect of improved nutrition on life expectancy, health, self-esteem, and so on. We would permit the regulator to make those guesses; our only requirement is that it quantifies them.

Next, the regulator must issue a plan that explains how it will test its assumptions. At one extreme, the regulator might implement a randomized trial by mandating the new lunches for some children and not others. But randomized trials are expensive and not always practical. Another approach is to plan to conduct surveys of schools and families, in order to find out whether children throw out lunches or eat them, and of doctors, who might be asked to report if obese children in the

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151 This is already done from time to time, as illustrated by the establishment of the INTERAGENCY WORKING GRP. ON SOC. COST OF CARBON, U.S. GOV'T, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12866, at 1–3, 33 (2010), https://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf [https://perma.cc/93UM-CLS3].

152 Nutrition Standards in the National School Lunch and School Breakfast Programs, 77 Fed. Reg. 4088, 4107 (Jan. 26, 2012) (codified at 7 C.F.R. pts. 210 & 220).

program lose weight. All of this information can then be used at a later time to evaluate the regulator's initial assumptions.

When the review period arrives, we might discover, for example, that the regulator over- or underestimated the number of children who would throw out lunches. If so, in deciding whether to renew the regulation, the regulator would be required to update this assumption, even while it would be allowed to make guesses with respect to valuations or probabilities that remain unknown. If the regulator changes these valuations without explanation in order to maintain that the regulation is no longer cost-justified based on the posterior with respect to the assumption in question, then the reviewer may well be skeptical that the regulator acts in good faith.[153]

D. Two Examples

1. *The EEOC's ADA Regulations*

In 2011, the EEOC issued a regulation that expanded the definition of "disability," broadening the class of people entitled to "reasonable accommodations" under the Americans with Disabilities Act.[154] The EEOC expected the regulation to benefit disabled people by entitling them to assistance and other forms of accommodation from their employers, which would in turn also make it more difficult for employers to fire them for failing to perform their job adequately. The EEOC also acknowledged that the regulation would impose costs on employers, who would be required to provide possibly expensive accommodations and retain people who do not contribute much to the bottom line.

On the cost side, the EEOC used surveys and other sources of information to estimate the total number of people in the work force with disabilities and the fraction of them not covered by the older, narrower definition. The final estimate was 12 to 38.4 million people.[155] Another survey (of disabled

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153 To our knowledge, there has not been any discussion in the legal literature of the use of Bayesian cost-benefit analysis by regulators. However, Bayesian approaches to cost-effectiveness analysis, which is closely analogous, have been explored in the medical literature. *See, e.g.*, Andrew H. Briggs, *A Bayesian Approach to Stochastic Cost-Effectiveness Analysis*, 17 INT'L J. TECH. ASSESSMENT HEALTH CARE 69, 70–71, 75 (2001). And there has been some discussion by law professors of Bayes' Rule in the context of policy evaluation. *See* Matthew D. Adler, *QALYs and Policy Evaluation: A New Perspective*, 1 YALE J. HEALTH POL'Y, L., & ETHICS 1, 53–54 (2006); Strnad, *supra* note 139, at 200–03.

154 Regulations to Implement the Equal Employment Provisions of the Americans With Disabilities Act, as Amended, 76 Fed. Reg. 16978, 16987 (Mar. 25, 2011) (codified at 29 C.F.R. pt. 1630).

155 *Id.* at 16991–94.

people) suggested that 16% of the people under the new definition would request a new accommodation that would be required under the new regulation. That implied 2.0-6.1 million requests.[156] Next, using another source of data (from a survey of employers), the EEOC estimated the mean cost of an accommodation at $150. After further calculations, the EEOC estimated the cost of the regulation at $60-$183 million per year.[157]

On the benefits side, the EEOC acknowledged that in its preliminary impact analysis, it did not attempt to quantify or even itemize the possible benefits from the regulation.[158] In response to comments, it noted that a survey existed that separately itemized the benefits of accommodation ("[c]ompany retained a valued employee;" "[i]ncreased the employee's productivity;" etc.).[159] While the survey did not ask employers for the monetary value of these benefits, the EEOC observed that retention is valuable because it avoids the cost of hiring a person—which on average was $1,978 in 2009. The EEOC also said that the regulation would improve "[e]fficiencies in [l]itigation," create "[f]uller [e]mployment" (which "will stimulate the economy"), generate "[n]on-discrimination and [o]ther [i]ntrinsic [b]enefits," which would reduce "stigma, exclusion, and humiliation, and promote[ ] self-respect," and so on.[160]

This analysis of benefits is plainly inadequate. Most of the benefits are not estimated. The one quantification implicitly assumes that an employer would not (on average) voluntarily pay $150 for an accommodation in order to avoid spending $1,978 to find a replacement. The EEOC could have, and should have, done better.

The starting point is to estimate the value of the accommodations to employees. To use one of the EEOC's examples, the regulation might mandate an employer to offer voice-recognition technology to an employee who has multiple sclerosis and hence difficulty typing. The worker would clearly be willing to pay a positive amount for this assistance, which will make work easier or more pleasurable. That amount could be estimated with the help of surveys; even if surveys are too expensive, the regulator may be able to make some reasonable guesses. For example, if the worker is paid $20 per hour and

156 *Id.* at 16992.
157 *Id.* at 16998
158 *Id.* at 16996–98.
159 *Id.*
160 *Id.*

must work five hours in order to perform work that other workers can do in four hours, then the benefit is worth $20 for every five hours of work. (In five hours, the worker can earn $125 rather than $100.) Similar sorts of calculations can be performed for other types of accommodations.

The EEOC would also need to take into account the fact that the regulation takes place within the labor market. This raises two additional issues. First, the EEOC would need to satisfy itself that employers do not offer accommodations that would save themselves money. This is, of course, possible; but it is most likely to be true when the benefits do not fully accrue to the employer. For example, if an accommodation requires the employer to train the worker to use voice-recognition technology, the employer will not capture the benefits of the training if the worker uses this training at home or in future jobs.

Second, the EEOC must take into account the risk that employers might refuse to hire disabled people because of the cost of providing them with accommodations. The EEOC's bland assurance that the regulation would increase employment is belied by empirical evidence that the ADA reduced rather than increased employment of disabled people.[161] A framework exists for estimating the possible unemployment effects of mandates, and the EEOC should be required to use it in order to estimate the employment effects of the regulation.[162]

A final point is that even if the EEOC could not have reasonably undertaken these calculations, the EEOC should have stated an explicit guess as to what it believed the benefits of the regulation would be. Imagine that the average wage of the people affected by the regulation was $40,000 and that the effect of the regulation was either to make work somewhat easier or to enable a person to take a more preferred over a less preferred job. We could imagine the EEOC reasonably guessing that an affected person would pay, say, $1,000 for the accommodation. As a result, the regulation would pass a cost-benefit analysis.

But this is not an empty exercise. For one thing, it would bar outrageous guesses ($100,000 or even $10,000) that would rationalize a much more expensive regulation. More impor-

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161 *See* Daron Acemoglu & Joshua D. Angrist, *Consequences of Employment Protection? The Case of the Americans with Disabilities Act*, 109 J. POL. ECON. 915, 917 (2001).

162 *See* Christine Jolls, *Accommodation Mandates*, 53 STAN. L. REV. 223. 230–72 (2000).

tantly, the EEOC would be on record. In the future, employers would be permitted to come forth with surveys and related evidence that show that workers value the benefits at only $50 or $100 on average. If employers plausibly made such a case, then the EEOC would be required to declare that the regulation fails a cost-benefit test.

2. *The EPA's Mercury Regulation*

The regulation in our data with the greatest projected economic cost is the EPA's 2012 regulation of coal- and oil-fired power plants.[163] This regulation was triggered by an EPA finding that mercury—which these types of plants emit—is a hazardous air pollutant that the EPA must regulate under §§ 111 and 112 of the Clean Air Act. As we explained, the EPA quantified only one benefit from reducing mercury: reduction in the harm to children's intelligence from ingesting mercury when eating freshwater fish.[164] The EPA estimated that the regulation would prevent the loss of 510.8 IQ points across all affected children, which it valued at approximately $5 million (or $10,000 per point of IQ).[165] The EPA also quantified the regulatory benefits from reducing emissions of various types of particulate matter, which would be affected by the same technologies used to reduce mercury emissions.[166] The EPA described these as "co-benefits," because the EPA's authority to regulate power plants derives from the fact that they emit mercury, and the benefits of reducing particulate matter are ancillary to the regulation of mercury.[167] The EPA calculated that the particulate matter reductions would result in approxi-

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163 National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9304, 9307 (Feb. 16, 2012) (codified at 40 C.F.R. pts. 60 & 63).

164 EPA *supra* note 3, at ES–11 tbl.ES–5.

165 *Id.* at ES–5 tbl.ES–3, ES–6 tbl.ES–4.

166 Particulate matter includes a variety of metallic compounds, such as chromium compounds, which are known carcinogens and have a significant impact on respiratory health. *See* National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. at 9,360; EPA, *supra* note 3, at ES–5 tbl.ES–3, ES–6 to ES–7 tbl.ES–4.

167 EPA, *supra* note 3, at 5–1.

mately $63 billion in benefits, against approximately $9.6 billion in costs.[168]

It might seem as though the EPA's failures to quantify additional mercury-related benefits should be irrelevant in light of this large disparity between costs and benefits. But as we described in the introduction, that was not the case. In *Michigan v. EPA*, the Supreme Court struck down the regulation because of the disparity between the costs and benefits of the mercury effects alone.[169] The explanation stems from the nature of the EPA's legal authority. The EPA was required to "perform a study of the hazards to public health reasonably anticipated to occur as a result of emissions"[170] and then promulgate regulations if it finds that "regulation is appropriate and necessary" with respect to any given air pollutant.[171] The EPA conceded, and the Court agreed, that when it made this "appropriate and necessary" finding with respect to mercury, only the benefits and costs related to mercury were relevant.[172] That is, the EPA was not permitted to account for any ancillary regulatory benefits such as particulate matter reductions. If one considers only mercury, the cost-benefit ratio looks very bad: $9.6 billion in costs to only about $5 million in benefits.[173] This unfavorable ratio placed the EPA in the uncomfortable position of having to argue that costs were irrelevant to the appropriate-and-necessary finding that triggered the EPA's obligation to regulate mercury. Despite the fact that the EPA was entitled to *Chevron* deference, the Court rejected this argument.

The EPA was right to perform a cost-benefit analysis and to promulgate a regulation whose benefits exceeded its costs. Our point is that the EPA's failure to fully quantify mercury benefits likely had both policy and legal ramifications. From a policy perspective, the EPA might well have chosen to promulgate a more stringent regulation had it fully understood the benefits of regulating mercury. And from a legal perspective, a more thorough accounting of the benefits of eliminating mer-

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168 *Id.* at ES–2 tbl.ES–1. The EPA estimated that the regulation would produce between $37 and $90 billion in benefits at a 3% discount rate; the figure in the text is the midpoint of the range. *Id.*

169 135 S. Ct. 2699, 2711 (2015).

170 *Id.* at 2705 (quoting 42 U.S.C. § 7412(n)(1)(A) (2012)).

171 *Id.* (quoting 42 U.S.C. § 7412(n)(1)(A)).

172 *Id.* at 2706, 2711 (quoting 42 U.S.C. § 7412(n)(1)(A)).

173 *Id.* at 2706.

cury might have allowed the rule to survive the Supreme Court's aggressive standard of review.[174]

What should the EPA have done differently? To begin with, it should have estimated the other mercury-related benefits it was aware of. The EPA's Regulatory Impact Analysis lists several other unquantified mercury-related benefits: reducing developmental delays, memory loss, and behavioral dysfunctions; reductions in various harms to cardiovascular health; and avoiding a variety of toxic immunologic effects.[175] The regulation also mentions environmental benefits to fish, birds, and mammals and to the recreational hunters and fisherman who catch them.[176]

Surprisingly, the agency acknowledged that it has access to significant information on all of these effects. It has quantified the mercury reduction from the regulation, which it estimated at approximately 19.9 tons in the first year of the regulation (2015), with similar amounts in subsequent years.[177] In order to determine the regulatory benefits to children, the EPA first determined which waterways the regulation would affect. Then, using census tract data, it calculated the number of people living in proximity to those waterways. It then employed survey data to determine the percentage of those individuals who catch and eat freshwater fish. The EPA next used fertility rate data to estimate the number of children who would be exposed to mercury prenatally when their mothers ate freshwater fish.[178] The EPA's model thus took the form:

$$\begin{aligned}\#\text{ children exposed} = \#&\text{ people near affected waterways} \times \\ &\text{percentage who are anglers} \times \\ &\text{fertility rate}\end{aligned}$$

The EPA ran this calculation on an extensive database comprising all 64,500 census tracts and over 5,000 waterways to arrive at the conclusion that approximately 239,000 children are affected each year.[179] Along the way to this conclusion, the EPA necessarily calculated the number of adults who consumed mercury—the calculation of the number of affected chil-

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174 The rule should have survived judicial review in any event because overall benefits dramatically exceeded costs. The Court's focus on mercury costs and benefits, to the exclusion of other considerations, only highlights the importance of fully quantifying costs and benefits.

175 EPA, *supra* note 3, at ES–11 tbl.ES–5.

176 *Id.* at ES–12 to ES–13 tbl.ES–6.

177 *Id.* at 3–10.

178 *Id.* at 4–38 to 4–45, 48–49.

179 *Id.* at 51–53 tbl.4–5.

dren is based upon the number of adults discounted by the fertility rate. But the agency never reported this figure (or any of the underlying data); the number of children is the only reported measure.

The EPA then used survey data and a database of over 50,000 water samples that it had tested to determine that the average mother (of these 239,000 children) would consume 3.04 micrograms of mercury per day.[180] The agency used further modeling to estimate that this would produce a total IQ loss across all children of 25,545 points, or approximately 1/10 of an IQ point per child. The regulation would reduce mercury deposits by approximately 2%, resulting in a net benefit of 510 IQ points, or approximately 1/500 of an IQ point per child.

With its data on the number of affected adults (which the agency possesses but does not report), its information on the reductions in mercury composition, and models of the other health effects of mercury, the agency could have provided further estimates of the benefits of mercury reduction. Sources exist that could have been used to model the effects of mercury reductions on other types of health benefits. The EPA directs anyone seeking "more information" to the EPA's own 2002 Integrated Risk Information System (IRIS) on methylmercury, which includes models of mercury's health effects and the benefits of reducing exposure.[181] The EPA also directs readers to a 2000 study by the National Research Council of the National Academy of Sciences, which "provides a thorough review of the effects of [methylmercury] on human health."[182] The EPA even produced its own mercury study in a 1997 Report to Congress, which details many of the environmental harms associated with mercury and provides estimates of the benefits of mitigation.[183] Finally, there is a substantial body of nongovernmental scientific evidence documenting the effects of mercury exposure on life and health.[184]

To get a sense of the potential magnitude of these other health effects, consider the following back-of-the-envelope calculation. Suppose that the average adult lives until age sev-

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180 *Id.* at 54.

181 *Id.* at ES–11 tbl.ES–5.

182 *Id.* at 4–4.

183 EPA, *supra* note 8, at O–1 to O–4, 4–2 to 4–4 tbl.4–1 (providing an eight volume report detailing the magnitude of U.S. mercury emissions and their implications).

184 *See, e.g.*, HASSAUER ET AL., *supra* note 8, at 3–4 (surveying the literature of mercury toxicity).

enty and that each adult has on average one child. In any given year, if there are 239,000 children exposed to mercury prenatally, there will be 16.73 million adults exposed. (Again, the EPA calculated but did not report this figure.) Imagine that mercury exposure at current levels creates a 1 in 50,000 risk of suffering a fatal heart attack and that the effect is linear. That would mean that at current emissions levels, 334.6 adults will suffer fatal heart attacks due to mercury's effects on cardiovascular health. A regulation that reduced mercury concentrations by 2% would eliminate 6.7 fatal heart attacks. The EPA values a statistical life at $7.4 million.[185] These cardiovascular benefits would then have a value of $48.9 million—significantly higher than the IQ benefits.

To justify its failure to make these calculations, the EPA argued that it did not have "sufficient confidence in available data or methods," that "current evidence is only suggestive of causality or there are other significant concerns over the strength of the association," and that it faced "time and resource limitations."[186] The agency should have offered its best estimate of the regulation's benefits given the information available to it, while explaining and documenting any sources of uncertainty. This might have cast the agency's decision to regulate mercury, despite only $5 million in quantified benefits, in a different light.

Less legally significant than the agency's failure to estimate additional mercury-related benefits is its failure to estimate the benefits of reductions in ozone, sulfur dioxide, nitrogen dioxide, and carbon dioxide emissions.[187] Any reduction in emissions from coal- and oil-fired electrical plants will necessarily reduce emissions of these gases, along with mercury and particulate matter. The benefits to life, health, and the environment from reduced emissions of these four gases are extensive. Moreover, the EPA has regulated all of these gases in different contexts, and so it has already priced many of the benefits.[188] (With respect to these gases, the EPA relied heavily on the

185 *Mortality Risk Valuation*, EPA, https://www.epa.gov/environmental-economics/mortality-risk-valuation [https://perma.cc/4MBG-RYHJ] (estimating the value of a statistical life in 2006 dollars).

186 EPA, *supra* note 3, at ES–11 nn.b–d.

187 *See id.* at ES–10 to ES–13 tbl.ES–6.

188 *See id.* For instance, an interagency group, which included the EPA, has already put a price on reduced carbon emissions. *See* Jonathan S. Masur & Eric A. Posner, *Climate Regulation and the Limits of Cost-Benefit Analysis*, 99 CALIF. L. REV. 1557, 1566 (2011) (noting the available data on carbon dioxide regulation costs).

excuse that it was constrained by "time and resource limitations for this analysis."[189]) Even though a full accounting of these benefits would not have refuted the legal challenge to this regulation, the EPA's decision to leave them unquantified was nonetheless unwise.

CONCLUSION

Agencies regularly promulgate regulations for which they do not fully quantify costs and benefits. This is the norm, not the exception; between 2010 and 2013, agencies promulgated only two major regulations with fully quantified benefits and costs and more than 100 regulations without. In many cases, these regulations involved significant, measurable costs in excess of $100 million and no quantified benefits. Nonetheless, the agencies proceeded with the regulations based upon little more than conclusory statements that, in the agencies' judgments, the benefits justified the costs. This is not sound practice.

We do not argue that agencies should regulate only when they can monetize, with a high degree of confidence, all benefits and all costs. To the contrary, we advocate that agencies state their priors about the benefits and costs they cannot fully quantify; update those priors given the evidence available to them; and proceed with regulation if they believe that the benefits outweigh the costs. The agency must make clear its priors and provide as much information regarding costs and benefits as it can gather, rather than omitting critical information. Those priors should then be scrutinized and updated as further information becomes available. OIRA should lead the way by rejecting proposed regulations that do not take these steps. Courts should reject as arbitrary and capricious any regulation based upon priors that an agency does not properly update. Uncertainty should not be an insurmountable barrier to agency action, but it should not be used to provide cover for regulation that cannot be justified.

We also think that regulators should be allowed to cite equity, dignity, fairness, and distributive impacts, but they must avoid using these ideas as boilerplate. Distributive impacts can and should be identified (they never are). And none of these concepts should be used as an excuse for failing to quantify benefits. If the regulator believes that a regulation

189 *See* EPA, *supra* note 3, at ES–11 n.b, ES–13 n.b, 5–5 n.a, 5–7 n.a.

that fails a cost-benefit analysis should nonetheless be issued, it should still disclose the cost-benefit analysis.

Uncertainty cannot be wished away, but it can be addressed with institutional methods. Under the dynamic approach we advocate, regulators will often rely on priors—in the vernacular, they will have to "guess." But they will be required to identify their priors in quantitative terms and use institutional mechanisms to ensure that the priors are updated in a rigorous way. The alternative is economically unsound and may in some cases be legally fatal.