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## Regulatory policy: what role for retrospective analysis and review?

**Abstract:** Given that President Obama's Executive Orders on regulation have emphasized the importance of retrospective analysis and review of existing federal rules, I survey the state of retrospective analysis and review of federal regulations. I first ask how much is known about the economic merit of past federal regulatory decisions, based on retrospective economic analyses of their effects. I review reports of the Office of Management and Budget and related literature, but unlike those reports I find only five rules, issued by the National Highway Traffic Safety Administration (NHTSA), for which retrospective analyses provide estimates of both costs and reasonably good proxies for benefits (e.g., adverse health effects avoided). Other retrospective studies of federal rules estimate are incomplete, estimating only the compliance costs, or only the benefits, or only costs and measures of effectiveness, like emissions reductions, which do not closely relate to people's welfare.

I also seek to explain differences in the practice of retrospective analysis and review between NHTSA, which appears to have the best record of retrospective analyses among federal agencies, and the Environmental Protection Agency (EPA), an important regulatory agency. I find that NHTSA regularly conducts such analyses and reviews, while EPA rarely does retrospective analysis and presents rulemakings that look like business as usual as being the result of a retrospective review. I analyze the role of data limitations, statutory authority, and institutional incentives in influencing the different behaviors of these two agencies. I conclude that differences in data availability and in particular the lack of relevant control groups, are an important barrier to retrospective analysis at EPA. This data deficiency, combined with important restrictions on EPA's ability to consider information on net benefits or cost-effectiveness in its rule-making, are together the biggest hindrance to generating better information about the effects of its rules. I conclude with recommendations intended to generate more measurement of the actual effects of regulations.

**Keywords:** retrospective regulatory analysis; regulatory review.

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President Obama (2011a, 2011b, 2012) has issued three executive orders that provide new emphasis on the analysis and review of existing federal rules. He stated that our regulatory system “*must measure, and seek to improve, the actual results of regulatory requirements*” (emphasis added) (Obama 2011a). The passage of two years since the issuance of these Executive Orders provides an occasion to evaluate the state of retrospective analysis of regulation, and thus the state of understanding of the economic effects of federal regulations as they have been implemented.

More measurement, analysis, and review of existing federal regulations are overdue and surely needed. Professor Michael Greenstone, who served as Chief Economist of the President’s Council of Economic Advisers, wrote that “The single greatest problem with the current system is that most regulations are subject to a cost-benefit analysis only in advance of their implementation. This is the point when the least is known and any analysis must rest on many unverifiable and potentially controversial assumptions.” (Greenstone 2009). Indeed, the main analytic efforts under President Clinton’s Executive Order 12866 (1993) on regulatory planning and review have been on the analysis of pending new rules. Not only is such analysis hindered by the lack of information about the effects of such pending rules, but it is also limited to the flow of new regulations, which represent a small part of the total regulatory system. The Code of Federal Regulations, which includes all promulgated final rules but excludes their lengthy preambles as well as proposed rules and documents like meeting announcements, had 168, 159 pages in 2011 (Office of the Federal Register 2012). Since 1970, its total pages have tripled, growing on average by 2.8% annually. Thus by this measure the stock of existing federal regulations, which are rarely subjected to careful study, may be 30 times larger than the annual flow of new regulations, some of whose effects are subject to analysis under E.O. 12866. The focus of benefit-cost analysis on the flow of new rules leads to questions about what is known about the effects of federal regulations as they have been implemented.

Knowing more about the actual effects of federal regulations as they are implemented in practice may offer several benefits. First, retrospective estimates of actual effects may mitigate controversy, especially if they serve to validate prospective estimates. A reduction in controversy may be important in certain policy arenas, such as environmental protection, where rules are routinely subject to lengthy litigation that creates substantial and costly uncertainty. Second, information about the retrospective estimates of benefits and costs may increase credibility of prospective estimates. Additional credibility is needed because prominent critics of benefit-cost analysis, focusing on prospective analysis, have argued that it is a deeply flawed device that “impedes rather than aids understanding of the concrete consequences of regulations” (Heinzerling 2008). Similarly, retrospective

estimates may provide insights to improve the accuracy of prospective analyses. Indeed, Arrow et al. (1996) wrote that, “Retrospective assessments of selected regulatory impact analyses should be carried out periodically.” Similarly, Litan and Hahn (1997), then heads of the Joint Center for Regulatory Studies of the American Enterprise Institute and the Brookings Institution wrote that federal “agencies could use retrospective studies of actual impacts to complement prospective studies. Those analyses would provide a better assessment of actual benefits and costs and would improve prospective estimation techniques.” Finally, results of retrospective studies can suggest changes to rules to improve the efficiency of the regulatory programs, though such studies can only complement and not substitute for careful prospective analyses.

In this survey of the state of retrospective analysis, I ask two questions about our understanding of the effects of federal regulations as they have been implemented. I pursue systematic approaches to address each question.

- a. How much is known about the economic merit of past federal regulatory decisions, based on retrospective economic analyses of their effects? To address this question, I review the retrospective analyses of federal regulations cited in the 2011 report to Congress by the Office of Management and Budget (OMB) on the Benefits and Costs of Federal Regulations, focusing on the quality and completeness of cost and benefits estimates. I investigate specifically whether the retrospective studies identified by OMB measure benefits in dollars, in physical units directly linked to people’s welfare (such as hours of work or cases of illness), or in physical units linked only indirectly to welfare, such as tons of emissions reduced. Despite use of the word “benefits” in the 2011 OMB report, I find only five rules for which retrospective analyses provide estimates of both costs and reasonably good proxies for benefits (e.g., adverse health effects averted). For these rules there is retrospective information adequate for judgments about net benefits or cost effectiveness, but for no other rules could I find any retrospective information about cost-benefit ratios per se. Indeed, the other retrospective studies cited by OMB that present cost estimates of federal regulations offer either no quantitative estimates of effectiveness, or estimates of effectiveness that are so indirectly related to people’s welfare as to preclude meaningful conclusions about the economic merit of the rules in question.
- b. What explains differences in the practice of retrospective analysis and review among federal agencies? Given the extremely wide scope of the federal regulatory state, I focus on a pair of regulatory agencies that treat retrospective regulatory analysis quite differently, believing this approach will better enable me to characterize and explain the difference in behavior. I select EPA because it is responsible for the federal rules with the highest costs and

benefits of any executive branch agency (OMB 2011), because EPA has conducted some retrospective analyses in response to statutory mandates and because I have professional experience with EPA's rulemaking. I pick the National Highway Traffic Safety Administration as a comparison because it has a longstanding and apparently unique practice of conducting retrospective analyses of its regulations. In addition, OMB (2005) reported that NHTSA, "has the best validation record among the agencies. Although it still shows a slight tendency to overestimate benefits and benefit to cost ratios, its overall record is significantly more accurate than the other agencies. NHTSA overestimated costs three times, underestimated costs twice, and was accurate three times." For these two federal regulatory agencies, I review their published plans for retrospective review and analysis and describe their current practices and selected recent retrospective studies. I then analyze the role of data limitations, statutory authority, and institutional incentives in influencing the different behaviors of these two agencies.

Before addressing these two questions in turn, I offer a brief history about retrospective analysis and review of regulations in the federal government. In the final section of this paper I offer some summary observations and conclusions.

## 1 Background

President Obama's Executive Order 13563 specifies a new process for retrospective analysis and review of federal regulations (Obama 2011a). Section 6 of E.O. 13563 states:

- (a) 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, and to modify, streamline, expand, or repeal them in accordance with what has been learned. Such retrospective analyses, including supporting data, should be released online whenever possible.
- (b) Within 120 days of the date of this order, each agency shall develop and submit to the Office of Information and Regulatory Affairs a preliminary plan, consistent with law and its resources and regulatory priorities, under which the agency will periodically review its existing significant regulations to determine whether any such regulations should be modified, streamlined, expanded, or repealed so as to make the agency's regulatory program more effective or less burdensome in achieving the regulatory objectives.

In July 2011, President Obama (2011b) issued Executive Order 13579, which applies to independent regulatory agencies and contains the same language, except that it uses the word “should” instead of “shall”. In May 2012 President Obama (2012) issued another E.O. specifically dedicated to retrospective review, further institutionalizing the process he established in E.O. 13563.

These provisions for analysis and review of extant regulations build on similar provisions in earlier executive orders. President Reagan’s Executive Order 12291 contained a provision directing agencies to conduct retrospective reviews of existing regulations (Reagan 1981). President Clinton’s Executive Order 12866, Section 5, directs each agency to submit to the Office of Information and Regulatory Affairs (OIRA) a program to periodically review existing significant regulations to determine whether any should be modified or eliminated to make the program more effective, less burdensome, or in greater alignment with the president’s priorities and the principles (Clinton 1993). It also authorizes the vice president to identify other existing regulations for agencies to review.

Reviewing the history of Section 5 of E.O. 12866 may shed light on current challenges to implementing retrospective regulatory review. In 1995, Vice President Gore’s National Partnership for Reinventing Government, undertook a major reform of the US regulatory system. In March 1998, it claimed that federal agencies “eliminated 16,000 pages of federal regulations” (Kamensky 1999). The Code of Federal Regulations’s total pages declined by about 7000 between 1995 and 1997, and in 1997 it contained about 14,800 fewer pages than it would have if growth from 1995 to 1997 had occurred at the 2.8% annual rate observed over the entire period since 1970 (Office of the Federal Register 2011). Pages of regulation are a simple and objective measure of regulatory complexity. But they are a relatively poor measure of total regulatory burden, and not clearly related to established economic concepts like compliance costs or opportunity costs.

The National Partnership estimated the reduced regulatory burden in dollar terms from the elimination of pre-existing regulations, but only at an early stage in its process (Kamensky 1999). During phase two in 1995, when the National Partnership undertook what it called a major reform of the regulatory system, it claimed, “Agencies identified \$28 billion a year in reduced regulatory burdens” (Kamensky 1999). The National Partnership does not state what analytic standards, if any, agencies followed in estimating the reduced regulatory burden from cutting existing regulations. In a later listing of accomplishments for its first five years, the National Partnership makes no mention of a specific reduction in regulatory burden. Thus, it is unclear what economic effect this initiative might have had. Put differently, the elimination of regulations regarding buggy whips and horse-drawn carriages might constitute good government housekeeping, but in the 1990s it could not promote efficiency. Thus one does not know what part of the regulatory reviews conducted

under the National Partnership might have resulted in the streamlining or elimination of obsolete regulations, like those covering buggy whips and horse-drawn carriages, and what part might have promoted efficiency by eliminating regulations with costs well above their benefits. In essence, any process of reform that purports to eliminate or improve existing regulations must also entail some economic analysis in order to defend claims that it generated savings.

Federal agencies must already review periodically extant regulations that disproportionately affect small businesses, according to an oft-neglected statutory requirement, Section 610 of the Regulatory Flexibility Act. Section 610 requires that each agency publish annually in the Federal Register a list of rules that have a significant economic impact on a substantial number of small entities and which are to be reviewed during the succeeding 12 months (Regulatory Flexibility Act). The list must describe each rule, its necessity, and its legal basis and also invite public comment on the rules (Sullivan 2008a). Section 610 is not having the intended effect, however. In congressional testimony in 2008, the Small Business Administration's chief counsel for advocacy stated (Sullivan 2008a), "Historically, federal agency compliance with Section 610 has been limited." He cited a July 2007 report issued by the Government Accountability Office (GAO) that found that "federal agencies' reviews of their current rules, including the periodic reviews required under Section 610, are neither as useful nor as open to public involvement as they should be" (GAO 2007).

The 2008 SBA testimony listed just four retrospective rule reviews that were "successful"; three of these followed the review process under Section 610 (Sullivan 2008b). The more recent track record of review under Section 610 is similarly lackluster. For example, the EPA, in its Spring 2011 unified regulatory agenda, notes that it is closing its Section 610 reviews for two regulations (EPA 2011a). One of these reviews, regarding Effluent Guidelines and Standards for the Centralized Waste Treatment Industry, lasted for 10 years and resulted in no changes to the rule, perhaps because the EPA received no comments about it. The other 610 review, which focused on EPA's National Primary Drinking Water Regulation for Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring, also ended with no changes to the regulation. In the EPA's January 2012 progress report on its final plan for periodic retrospective reviews of existing regulations, the agency offers no information about the review of specific rules under Section 610 (EPA 2012a). Instead, it simply mentions Section 610 as a requirement and states, "To the extent practicable, EPA will coordinate Section 610 reviews with other statutorily or Presidentially mandated retrospective reviews it is coordinating." Similarly, the Food and Drug Administration does not mention Section 610 in the discussion of its regulatory priorities that appears in the Fall

2011 Department of Health and Human Services statement of regulatory priorities (Department of Health and Human Services 2011).

In sum, federal agencies, at least prior to President Obama's executive orders, did not review extant regulations consistently or in a way likely to lead to clear improvements in efficiency, despite administrative and statutory directives that they do so.

## **2 How much is known about the economic merit of past federal regulatory decisions, based on retrospective economic analyses of their effects?**

To answer this question I use the 2011 OMB report to Congress on federal regulations (OMB 2011) as a point of departure. This report is the most recent OMB report to discuss retrospective review and analysis, and given OMB's role overseeing federal agencies, it is reasonable to presume it is the most authoritative summary. It indicates that there is an established literature sufficient to support retrospective judgments about the economic merit of federal regulations, at least in terms of their effects on efficiency, i.e., on benefits and costs. OMB reports favorably on some earlier work by researchers regarding retrospective analysis of benefits and costs, including work by Harrington (2006) on 61 rules "for which benefit-cost ratios could be compared *ex ante* and *ex post*" (OMB 2011). OMB reports that "Harrington's general conclusion is that while both costs and benefits turn out to be lower than prospective estimates, there is 'no bias in estimates of benefit-cost ratios'" (OMB 2011). OMB also summarizes an earlier 2005 report to Congress of "47 case studies": "At least from this [earlier OMB] study, it does not appear correct to conclude that agencies have systematically underestimated the ratio of benefits to costs, or that the benefits of rules usually turn out to be higher than anticipated" (OMB 2011).

I reviewed carefully the paper by Harrington and OMB's 2005 Report to Congress as well as the retrospective studies that they cite. I found that Harrington's critique of OMB's 2005 report on retrospective analysis uses language borrowed from the OMB Report about benefit-cost ratios. For example, Harrington labels his Table 7, "Benefit-Cost Ratios: Summary of Revised OMB Results with New Cases Added" (Harrington 2006). He also notes, that he finds "no bias in estimates of benefit-cost ratios". At the same time, however, Harrington makes clear that retrospective estimates of benefits estimates and even effectiveness are missing in

many cases, a fact that OMB does not acknowledge in its 2011 Report to Congress, although it cites Harrington's work.

- With respect to regulations to reduce vehicle emissions, Harrington provides a lengthy discussion of retrospective analyses of the costs of EPA regulations that express costs both per year and per gallon, but do not estimate any measures of benefits or effectiveness. Indeed Harrington notes, “it will probably be impossible to identify the emissions reductions from particular fuel and vehicle regulations *ex post*”, because of multiple regulations issued during the same period targeting the same pollutants (Harrington 2006). Of course, without a retrospective estimate of emission reductions one cannot develop a retrospective estimate of changes in air quality or health improvements. Thus a retrospective calculation of cost-effectiveness, let alone cost-benefit ratios, is likely impossible for these rules.
- With respect to regulations to ban pesticides, Harrington notes “Costs of pesticide bans are almost always estimated as the additional costs per acre for such actions as extra weeding, use of a substitute pesticide, or acceptance of reduced yields” (Harrington 2006). [Federal actions to restrict pesticide use were the largest single class of rules studied by Harrington (2006) and OMB (2005).] The number of acres not treated with a banned pesticide, while perhaps a measure of scale or scope, is not a proxy for benefits related to improvements in health or reduced environmental harm. Thus cost per acre not treated should not be seen as a measure of cost-effectiveness or a proxy for a cost-benefit ratio.
- With respect to the Department of Energy's appliance efficiency regulations, Harrington notes that, “no benefit estimates are cited” by OMB in its 2005 report (Harrington 2006). Prospective estimates of the effects of appliance efficiency regulations typically include estimates of the dollar savings from use of more efficient appliances, but the retrospective studies cited by OMB and Harrington lacked such estimates.

I conducted my own review of the studies listed by Harrington (2006) and OMB (2005 and 2011) and found no regulations for which retrospective studies provided enough information about both costs and benefits to reach a conclusion about the economic merit of the rule, with the notable exception of some rules issued by the National Highway Traffic Safety Administration. For example, Seong and Mendeloff (2004), provided retrospective estimates of the effects of selected occupational safety regulations on accidental occupational fatalities. But they did not develop estimates of the injuries avoided or the costs of the occupational safety regulations that they studied. Thus summary statements of cost-benefit ratios from retrospective studies of federal regulation obscure an unpleasant reality –

with the exception of retrospective studies of regulations issued by NHTSA, there appear to be no cost-benefit ratios estimated by retrospective studies. Indeed OMB (2005) acknowledged that it used the word “benefits” even in instances where the retrospective study in question did not estimate benefits in dollars or even in physical units. A footnote in OMB (2005) states (p. 42), “in most cases benefits were not monetized and, in some cases, unit benefits were not projected for health or environmental improvements.” Thus any discussion of cost-benefit ratios derived from retrospective studies of various federal regulations is inconsistent with the available literature.

The retrospective analyses of NHTSA merit elaboration. For five of the eight NHTSA rules listed by OMB (2005) as having retrospective analyses, there are retrospective estimates of both costs (in dollars) and benefits (either in dollars or quantitative estimates of reductions in mortality and injuries). These five rules, described more fully in OMB (2005), regulated

- bumper standards in 1982,
- dual airbags in 1984,
- center high mounted stop lamps in 1983,
- head restraints in light trucks in 1989,
- occupant crash protection, in the 1993 Federal Motor Vehicle Safety Standard No. 208.

These retrospective studies all take advantage of the availability of a reasonably well-defined control group. Analysts typically compared the accident records of vehicles that were mandated to have specific safety features with older but otherwise (nearly) identical vehicles that lacked those mandated safety features. Using a variety of statistical approaches, the comparisons gave estimates of the effectiveness of the mandated safety features on injury rates, as well as on the frequency and cost of accidents, relative to the control group. Thus the simultaneous presence on the road of newer vehicles with mandated safety features and older vehicles without such features permits estimates of the effectiveness and benefits of regulations that are difficult in other settings.

I searched the economics literature, Google Scholar, agency websites and asked federal economists for additional retrospective analyses of federal regulations and found a few analyses not mentioned in Harrington (2006) or OMB (2005). These additional analyses did not affect the conclusions stated above.

My search revealed that NHTSA (2011, 2013) completed 92 separate evaluations of the costs and/or the effectiveness of various facets of its regulatory program since 1973. For the years since 2005, NHTSA (2011) has completed 17 separate evaluations, suggesting that there is substantial continuing retrospective analysis at the NHTSA. These 17 reports, however, appear to estimate either costs or effectiveness

but not both, so reaching conclusions about cost-effectiveness may require integrating results from multiple reports, a potentially complicated exercise.

Through my search I also found some other retrospective analyses too recent to be cited in OMB (2005), but these were not informative about the economic merit of the original rule. For example, the Occupational Safety and Health Administration (OSHA) conducted a retrospective review of its methylene chloride regulation. OSHA (2010) concluded that the “standard remains consistent with Executive Order 12,866 because it has produced the intended benefits (i.e., protecting workers’ health), and has not been unduly burdensome.” This retrospective review did not provide quantitative estimates of compliance costs by firm or for the industry. It also did not provide quantitative estimates of workers’ reductions in exposure, although it did provide new evidence of toxicity in its review of its earlier risk assessment.

### **3 What explains differences in the practice of retrospective analysis and review among federal agencies?**

To address this question I analyze the practice of retrospective analysis and review at two agencies, EPA and NHTSA. I compare EPA with NHTSA because of EPA’s importance as a regulatory agency and because of NHTSA’s leadership in conducting retrospective studies. I first describe the differences in the agencies’ practices and then turn to an analysis of why their behavior is so different, focusing on data availability, statutory authority, and institutional incentives.

As described above, NHTSA has routinely conducted retrospective studies of its rules since the 1970s – they number more than twenty per decade. NHTSA’s retrospective studies typically focus on effectiveness in terms of prevention of injuries, deaths or accident costs, or the costs of new safety features. Comparisons of newer model vehicles with older model vehicles are an essential part of NHTSA’s approach to retrospective analysis.

Pursuant to President Obama’s E.O. 13563, the US Department of Transportation (DOT) (2011) offered a plan for retrospective review that included review of NHTSA’s rules. This plan mentions that NHTSA has prepared 10 evaluations of its rules’ effectiveness in the last two years (DOT 2011, p. 10). It also notes (DOT 2011) that the DOT had scheduled each of NHTSA’s existing rules as of 2008 for review during a specific year between 2008 and 2017. It thus appears that NHTSA’s retrospective evaluations are routine and its retrospective reviews comprehensive.

In a technical report, NHTSA (2004b) explains the methods it uses for retrospective analysis of costs. NHTSA states that its contractors perform detailed engineering “teardown” analyses, for representative samples of vehicles, to estimate how much specific federal motor vehicle safety standards add to the weight and the retail price of a vehicle. These analyses employ a process known as “reverse engineering”. Whereas conventional engineering proceeds from design and raw materials to mass-produced product, reverse engineering includes a step-by-step teardown or disassembly of each finished item into sub-assemblies and finally into individual component parts. The contractor weighs the components, identifies the type, unit cost and amount of raw material needed, and estimates the labor, variable burden, and tooling required to produce individual components and assemble them. In addition to these direct variable costs, the contractor estimates the mark-ups to the consumer’s full cost. By July 2004, NHTSA and its contractors claimed to have evaluated virtually all the cost- and weight-adding technologies introduced by 2001 in passenger cars and light trucks (including pickup trucks, sport utility vehicles, minivans, and full-size vans) in response to the safety standards.

NHTSA’s approach to cost estimation has several advantages over methods more common in retrospective evaluations of environmental regulation. It is not contingent on detailed surveys of regulated firms that may have strategic incentives to overstate their compliance costs. It does not require approval under the Paperwork Reduction Act, a potentially lengthy process that requires notice and comment. It also captures compliance costs while excluding the costs of voluntary adoption of safety features that were later mandated.

To illustrate further the nature of NHTSA retrospective studies I elaborate on the specifics of one prominent example – a detailed reappraisal of the cost and effectiveness of a 1983 final rule mandating center high-mounted stop lamps (CHMSL) on cars and light trucks. In each state and calendar year of police-reported crash data, NHTSA compared the ratio of rear impacts to non-rear impacts for model year 1986–89 cars (all CHMSL equipped) to the corresponding ratio in 1982–85 cars (mostly without the lamps) after adjusting the ratios for vehicle age (Kahane and Hertz 1998). This reanalysis found that reductions in injuries and damages observed retrospectively were <5% and much less than prospective estimates of 33% based on trials with random assignment, that prospective estimates of costs were also too low, and that net benefits were nonetheless large and positive. The abundance of data on police-reported crashes, as well as the availability of controls in the form of older vehicles without CHMSL, appear to contribute to NHTSA’s apparent comfort with retrospective analyses that reach different conclusions than its own earlier prospective analyses.

Thus NHTSA’s program of retrospective analysis and review appears well-established and sufficient to judge the effectiveness and or costs of a good number

of NHTSA rules. Discussions with analysts at NHTSA and OMB indicate that identifying an effect of these retrospective analyses on regulatory policy is difficult, however, largely because NHTSA makes policy based on information from a variety of sources, including new crash test results and engineering studies. Thus disentangling the effect of a single retrospective study on subsequent rulemaking is difficult.

The EPA, like NHTSA, has issued plans for retrospective review and analysis. EPA's September 2012 progress report (EPA 2012b) lists one retrospective analysis, a retrospective study of the costs of EPA regulations consisting of 5 case studies. This study, which is ongoing, focuses only on estimates of costs, and not effectiveness or benefits and thus is intrinsically less informative than the NHTSA retrospective studies of costs and effectiveness.

In its August 2011 final plan for retrospective review of regulations, EPA (2011b) states that "recent reforms, already finalized or formally proposed, are anticipated to save up to \$1.5 billion over the next five years." This estimate of specific cost savings includes savings from items that simply should not be part of any "retrospective review" because they are a normal part of conventional, ongoing rulemaking. For example, the largest single source of "savings" that the EPA lists is from a "re-examined proposal" dealing with the renovation, repair, and painting of homes that contain lead-based paint. The EPA's final plan for retrospective review assigns savings of \$278–\$300 million to this "re-examined proposal" although it is clearly unconnected to any retrospective analysis or review.

The EPA's January 2012 final plan (EPA 2012a) regarding retrospective review presents no summary statement of aggregate savings and even dropped the estimate of savings from the reexamination of its own proposal. Instead, the final plan simply describes the status of 40 different retrospective projects. Of these, only six rulemakings have estimates of potential costs or benefits per year, though some of these appear to be the same types of rules that the EPA might issue without any formal retrospective review process whatsoever. For example, EPA (2012a) describes one project titled "Multiple air pollutants: coordinating emission reduction regulations and using innovative technologies," by saying, "EPA intends to explore ways to reduce emissions of multiple air pollutants through the use of technologies and practices that achieve multiple benefits, such as controlling hazardous air pollutant emissions while also controlling particulate matter and its precursor pollutants." The EPA estimates incremental costs of \$2–\$4 million annually associated with these new emissions controls.

More recently, EPA (2012b) again updated its plan for retrospective review by issuing a new summary table, without an accompanying narrative. This update includes efforts for future rulemakings that are independent of any retrospective analysis or review. For example EPA (2012b) lists an effort to "harmonize

compliance requirements” with the Department of Transportation regarding the future greenhouse gas and corporate average fuel efficiency standards for model years 2017–2025. This effort is not related to any retrospective analysis or review of existing greenhouse gas and corporate average efficiency standard rules. EPA’s plan also include a possible new rule regarding electronic manifests for shipments of hazardous materials that the agency acknowledges that it could issue only if new legislation under consideration in the Senate were to become law. Thus, this rule is not the result of any retrospective review of existing rules except insofar as this phrase includes the review of rules that EPA wishes it had issued despite the lack of statutory authority.

In general, the eventual cost savings from the EPA’s efforts are mostly unquantified, but may be quite small. Its most recent update (EPA 2012b), provides mostly qualitative information about savings from its retrospective review. One rulemaking, to eliminate “redundant” requirements regarding vapor recovery, has estimated cost savings of \$87 million annually (EPA 2012a). It was the only action in EPA’s reports (2012a,b) with estimated savings of more than \$10 million per year.

One area where the President’s Executive Orders on retrospective analysis differed from earlier executive orders was a new emphasis on the measurement of “actual” results. Unfortunately, the EPA’s plan does not address what steps, if any, it plans to take to implement the president’s directive to measure “actual” results.

Overall, EPA’s plans for retrospective analysis and review are not impressive. Most of the retrospective reviews appear to be no more than a repackaging of EPA’s business as usual rulemaking. President Obama’s Executive Orders have prompted EPA to initiate one retrospective analysis comprised of five case studies of compliance costs, but not of benefits or effectiveness.

There are some older and fairly prominent retrospective analyses of EPA’s programs. One example is EPA’s own analysis of the benefits and costs of the Clean Air Act, which was mandated by Section 812 of the Clean Air Act Amendments of 1990. The 812 reports, unlike the other regulatory analyses discussed here, focused on the effects of the entire Clean Air Act, and not of specific provisions in the Act or of specific regulations implementing those provisions. Specifically, the EPA’s retrospective analysis (EPA 1997) focused on the differences between two scenarios: a scenario that reflects historical economic and environmental conditions observed with the Clean Air Act in place, and a hypothetical scenario that projects the economic and environmental conditions that would have prevailed without any of the federal, state, and local programs developed pursuant to the goals of the 1970 and 1977 Clean Air Acts. The analysis estimated that the total benefits in pollution reduction from Clean Air Act programs over the 20-year period were \$6–\$50 trillion. The mean estimate was about \$22 trillion, which was

roughly the same as the aggregate net worth of US households in that year (Lutter and Belzer 2000). The analysis also concluded that it cost \$523 billion to achieve those benefits. Although the report lacked information about any alternative scenarios other than its chosen baseline, it did offer some information suggesting that the baseline is dubious or at least questionable. In its baseline scenario of air quality without the 1970 Clean Air Act, six metropolitan areas would have been worse than Bombay, two would have been worse than Manila, and one would have been worse than Delhi, one of the world's most polluted cities. The report also lacked information about *parts* of the program. For example, it did not provide information about the costs and benefits of emissions control from mobile sources or about regulation of hazardous air pollutants separately. It also did not provide retrospective estimates of the benefits and costs of specific rules. In addition, the EPA's Section 812 report did not distinguish between air quality improvements due to Clean Air Act regulations and those attributable to all other causes (e.g., plant closures during the early 1980s recession and long-term shifts away from manufacturing and toward service industries). The EPA's report was less a retrospective analysis of the Clean Air Act and more an analysis of the implications for health and the environment of observed emissions trends relative to the implications of a hypothetical alternative emissions scenario.

EPA routinely updates or reissues some of its key regulations without subjecting the existing ones to a careful retrospective economic analysis. For example, in the EPA's 2006 regulation revising the national ambient air quality standards for fine particles, it did not assess the benefits and costs of attaining the existing standard even though many areas of the country still had not attained that standard, suggesting that the costs of such attainment were quite high (EPA 2006). Further, data and modeling limitations precluded the agency from assessing the benefits and costs of the standards for larger particles, which it decided to drop under the 2006 rule (EPA 2006). Similarly, the EPA's analysis in support of its draft final ozone rule, (EPA 2011c), which President Obama rejected in September 2011, also focused on more stringent standards and assumed a baseline of full compliance with the preexisting rule in 2020, except in two areas of California where compliance was deemed too challenging to be realistic even by 2020. These examples suggest that some important recurring regulations are updated or renewed based on an economic analysis that simply assumes full compliance with existing regulations, and not on a retrospective analysis of the benefits and costs of those regulations.

Finally, there is a robust academic literature evaluating the effects of EPA's actions, though most of it focuses on programs rather than specific rules. As one example, Greenstone (2002) studied differences in economic activity between plants located in counties that met the national ambient air quality standards and

those in counties that did not. He reported that during the first 15 years, from 1972 to 1987, the counties that fell short of attainment and were subject to more stringent regulations lost approximately \$75 billion of output in polluting industries relative to the other counties. Greenstone, however, focuses on the effects of various national ambient air quality standards for different pollutants, and not on the additional stringency associated with any specific NAAQS decision, such as the 1997 revision to the ozone NAAQS, or its NAAQS for  $PM_{2.5}$ . Similarly, Viscusi and Hamilton (1999) evaluated the incremental cost per cancer case averted in a large sample of Superfund sites subject to mandatory remediation and showed that the cost was quite high. They reported that costs for the 5th percentile, the median, and the 95th percentile, respectively, were \$145 million, \$5 billion, and \$200 billion per cancer case avoided. Although there may be other benefits of Superfund cleanup, including noncancer health effects and the value of increased services from improved water quality, these estimates of cost effectiveness are so high as to suggest strongly that Superfund cleanup is an unwise and inefficient use of scarce resources. In a more recent study of Superfund, Greenstone (2010) presented a preliminary retrospective analysis and concluded, “Available evidence suggests that the benefits from Superfund clean-ups to the people living near these sites are small, at least relative to the costs of these clean-ups.” Neither study, however, identified specific EPA regulations as key contributors to these apparent inefficiencies.

At the risk of oversimplifying the practice of retrospective analysis at NHTSA and EPA, NHTSA appears comfortable conducting retrospective analysis of individual rules, even if such analysis leads to conclusions at odds with its earlier prospective analysis. EPA, on the other hand, does not routinely conduct retrospective analysis of the cost-effectiveness – let alone the net benefits of individual rules. Instead its retrospective analysis as well as that of respected academics evaluating EPA’s actions, have focused on entire EPA regulatory programs.

In analyzing the likely causes of these differences in regulatory practice between NHTSA and EPA I turn first to differences in statutory authority between the two agencies. The statute authorizing motor vehicle safety standards invites consideration of cost effectiveness. Each standard “shall be practicable” (49 USC Section 30111 (a)). In addition, the Secretary, when prescribing a motor vehicle safety standard under this chapter, “shall consider whether a proposed standard is reasonable, practicable and appropriate” (49 USC Section 30111 (b)). These notions are echoed in NHTSA’s explanations of its regulatory decisions. For example, in a final rule upgrading NHTSA’s head restraint standards, the agency acknowledges that cost effectiveness estimates heavily influence its regulatory decisions. It notes, “in light of the newly refined, higher estimates of the cost per equivalent life saved, we conclude that rear head restraints should not be mandated” (NHTSA 2004b).

As is well known, EPA faces substantial statutory constraints on the consideration of net benefits, cost-effectiveness, or cost in issuing regulations, although such constraints differ among its program. For example, EPA's statutory authority to set national ambient air quality standards precludes it from considering cost in any way whatsoever (e.g., EPA 2010). EPA is allowed to consider costs and benefits in some circumstances in setting drinking water standards (e.g., EPA 2001). While the Safe Drinking Water Act requires EPA to review existing rules on a periodic basis, however, it also provides for a ratcheting of standards, stating in Section 1412(b)(9),

*“The Administrator shall, not less often than every 6 years, review and revise, as appropriate, each national primary drinking water regulation promulgated under this title. Any revision of a national primary drinking water regulation shall be promulgated in accordance with this section, except that each revision shall maintain, or provide for greater, protection of the health of persons.”*

One might view this requirement to maintain or increase the health protection from primary drinking water standards as discouraging retrospective analyses, since such analyses are irrelevant if they point toward less protective standards. In yet other programs, e.g., pesticide regulation, EPA's authority is based on “unreasonable risk”, i.e., consideration of benefits and costs (EPA 2013). Thus EPA operates under statutes that authorize or specify a variety of ways to consider net benefits and cost effectiveness in rulemaking.

Differences in rulemaking authorities, and particularly in the ability to consider net benefits or cost-effectiveness in rulemaking may be a factor in explaining differences in retrospective analysis between NHTSA and EPA, but they cannot be the sole explanation. If they were then EPA would have an established practice of conducting careful retrospective analyses for its pesticide regulations, and perhaps other areas where consideration of cost effectiveness is permissible, such as some effluent guidelines (e.g., Fraas and Munley 1989). Instead the agency's practice of retrospective analysis generally appears less developed than NHTSA's.

A second potential explanation of the differences in retrospective analyses between NHTSA and EPA has to do with the availability of data. As mentioned earlier, NHTSA is blessed with an abundance of natural control groups to use in estimating retrospectively the costs and effectiveness of its regulations. In particular, it can compare accident frequencies and severities on late model vehicles with those of earlier models that lack the newly mandated safety features. This type of study, which leads naturally to estimates of effectiveness in terms of reductions in injuries, fatalities and the costs of accidents, has no clear parallel in environmental policy. Analysts wanting to develop retrospective estimates of the effectiveness of regulations that reduce emissions face difficult challenges in

developing estimates of their effect on public health or the environment. Differences in air quality attributable to specific differences in emissions are typically observable and measurable only in unusual cases, such as temporary closures of large industrial sources that are regionally or at least locally important in terms of their contributions to concentrations of pollutants in the ambient air. Pope has conducted studies of this type based on a temporary shutdown of a steel plant in Utah (Pope 1989). Analysts wanting to develop retrospective estimates of the effects of *regulations*, however, generally have to rely on air quality models to link emissions cuts with air quality changes – too many factors influence air quality for statistical approaches to be generally practicable. To develop estimates of health effects, analysts must then use concentration response relationships from the epidemiological literature to infer changes in the incidence of adverse health effects that might be the result of improved air attributable to rule-driven declines in emissions. Of course such estimates are not really retrospective, so much as a hybrid of retrospective estimates of emissions levels and modeled estimates of the effect of such emissions levels on air quality and human health. Any such hybrid estimates would be subject to substantial uncertainty resulting from both the uncertainty in the emissions levels relative to the chosen counterfactual scenario and the air quality modeling and concentration-response relationships. It would lack the precision and credibility of the simpler approach that NHTSA is able to adopt because of the abundance of relevant data and the existence of appropriate control groups.

Finally, it is worth analyzing briefly the limited incentives for agencies to conduct serious retrospective analysis. Senior analysts and agency managers who design and oversee economic analyses of regulations, either retrospective or prospective, are typically rewarded according to whether the political leadership at such agencies views their analyses as useful in supporting their policy goals, which may (or may not) include the use of careful analytic methods. Put bluntly, what matters is often whether regulatory analysis is an effective weapon – either a sword or shield – in achieving the policy goals of the political management. Sometimes these goals are sound analysis, e.g., regulatory impact analyses that comply with federal guidelines. More commonly, however, they pertain to regulatory policy, i.e., the scope and stringency of regulatory programs. In such cases, retrospective analyses are typically less effective weapons, because their retrospective nature implies they are not directly related to the change in regulatory policy that leaders at regulatory agencies want, naturally, to achieve during their limited tenure. In addition, at both NHTSA and EPA as well as at other agencies, possible retrospective analyses compete for funds with prospective analyses. Prospective analyses are generally of greater use to policy makers, because they can be directly informative regarding pending policy decisions. Retrospective studies,

by comparison, can be more expensive (because they involve analysis of complicated data) and less clearly connected to any specific change in regulatory policy, because they are, by definition, retrospective. In sum, incentives for careful retrospective analysis at regulatory agencies are quite limited.

This analysis suggests that the retrospective analysis routinely conducted by NHTSA reflects an unusual confluence of happy occurrences. An abundance of data permits the identification of useful control groups for timely retrospective analysis of effectiveness at reducing risks to health or damages, as well as compliance costs. Statutes authorize regulations based partly on economic concepts like cost-effectiveness or net benefits. Together they create a consistent flow of careful retrospective analyses that ensure NHTSA's regulatory program has an empirical basis in the measurement of the actual effects of its regulations.

## 4 Discussion and Recommendations

The differences in retrospective analysis and review between EPA and NHTSA suggest any recommendations ought focus on how to make EPA more like NHTSA, particularly with respect to the availability of data, especially data on risks and costs for suitable control groups. Specifically, the issue is how to provide researchers of EPA rules with data from control groups like the early model motor vehicles that lack NHTSA's mandated safety features. One simplistic approach would be to randomly assign sources of pollution to adopt either specified control measures or ineffective "placebo" measures that do not reduce emissions or water discharges, etc. Analysts could compare the costs of sources in each group, along with the direct effects of the control measures (reduced emissions, etc.) as well as the indirect effects (improved air quality, reduced risks of disease and mortality). This approach would undoubtedly generate substantial new and valuable data. On the other hand it would appear flatly to contradict a collection of environmental principles, such as equal environmental protection for all. It could also create strong incentives for sources to lobby for the "placebo" control measures so as to avoid the costs of adopting the real control measures.

Given these design difficulties a sensible recommendation would be to offer monetary prizes to researchers who develop pilot studies or field trials that would economically generate such data while also being respectful of a specified set of environmental principles. A related recommendation would be offer prizes to researchers who develop ways of incorporating into environmental regulations data generation mechanisms that permit meaningful *ex post* measurement of the effect of a rule on environmental quality or on risks of disease and death and the

like. Of course such studies would have to be designed carefully to provide sufficient statistical power.

Whether such data are collected before or after a rule is implemented, the resulting data would likely be helpful in understanding regulatory effects, but they also would offer other benefits. If made publicly available to all interested researchers, the resulting data would also go a long way to mitigating concern that a regulatory agency is not conducting its economic analysis in an impartial manner.

Note that the biggest challenge to such a data generation effort is not the design of the pilot project or field trial or randomization. Instead it is the design of a data collection procedure that meets concerns of environmentalists about equity and appropriate levels of protection. If successful, however, such data collection procedures would help achieve President Obama's goal of measuring the actual effects of federal regulations.

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