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The Role of Distribution in Regulatory Analysis and Decision Making

Lisa Robinson

Harvard Kennedy School
Harvard School of Public Health

James Hammitt

Harvard School of Public Health

Richard Zeckhauser

Harvard Kennedy School

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The Role of Distribution in Regulatory Analysis and Decision Making

Lisa A. Robinson***, James K. Hammitt**, and Richard Zeckhauser*

*Harvard Kennedy School, **Harvard School of Public Health

Abstract: Before promulgating major environmental, health, or safety regulations, U.S. government agencies are expected to assess each regulation's costs and benefits, as well as its distributional impacts. We systematically review a dozen major regulations issued between 2009 and 2011, with a predominant focus on environmental regulations, to see whether this expectation is met. We find that agencies provide little information on distribution, often simply noting that the regulation will not adversely affect the health of children, minorities, and low-income groups. The reason for this inattention may be philosophic. Regulators may believe they should choose the option that maximizes net benefits as long as the health of these particular groups is not harmed. Other reasons may be more pragmatic. Regulators may worry that reporting the distribution of the impacts will raise issues they lack the legal authority to address; they may believe that distributional impacts are too small to warrant attention; or they may lack needed data, technical guidance, time, or resources. The current approach seems problematic because it focuses on avoiding health-related losses without considering the distribution of benefits or monetary costs. However, it is unclear whether more complete and routine analysis is desirable. Additional work is needed to determine whether the value of such information outweighs the costs of developing it.

Keywords: regulation, benefit-cost analysis, distribution, equity.

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The Role of Distribution in Regulatory Analysis and Decision Making

1.0 Introduction

Before issuing major environmental, health, and safety regulations, federal agencies are required to estimate their costs and benefits; they are also expected to assess how such impacts are distributed. While agency adherence to the requirements for benefit-cost analysis has been well studied (see Hahn and Dudley 2007, Harrington et al. 2009, Fraas and Lutter 2011, Ellig et al. 2013), little attention has been paid to the use or non-use of distributional analysis. This paper fills that gap, by systematically reviewing a dozen major regulations developed from 2009 through 2011 to explore the conduct of distributional analysis and its implications for decision making. Seven of the twelve regulations are from the U.S. Environmental Protection Agency (EPA). They account for a significant majority of the estimated costs, and an overwhelming majority of the estimated benefits.

Questions about distribution are often raised by scholars, decision makers, members of interest groups, and concerned citizens, but answering them raises difficult and contentious issues. Some questions are positive. To what extent do regulations benefit or harm those who have high or low incomes, or who are in good or poor health, more or less vulnerable to disease, or very young or very old? Do regulations disproportionately affect members of minority groups or residents of particular geographic areas? Although such questions can be answered through research, these concerns have not been comprehensively addressed in the context of federal environmental, health, or safety regulations. Previous research generally focuses narrowly on particular types of impacts or policies (see Parry et al. 2006, Banzhaf 2011, Bento 2013 for reviews). In particular, many authors have addressed environmental justice--the impact of environmental contaminants on the health of low-income and minority groups. The distributional implications of air-pollutant taxes and permits have also received attention (for example, Grainger and Kolstad 2010). Few studies address the distribution of both the costs and benefits of conventional environmental, health, or safety regulations.¹

Theory suggests that aggregate regulatory impacts may be regressive, benefitting the wealthy more than the poor (see Fullerton 2009 and 2011). Regulation may increase the prices of goods (such as electricity) that constitute a larger fraction of low-income than of high-income budgets while providing benefits (such as a clean environment) that likely are valued more by those with higher incomes. However, without more empirical research, we lack evidence on the extent to which these expectations hold true.

Normative questions are more difficult to address.² Should we weigh benefits and costs differently depending on who is affected? If so, should we place greater weight on avoiding

¹ We found only one reasonably recent study (Shedbegian et al. 2007), that addresses both regulatory costs and benefits.

² For thoughtful discussions of the normative and positive components of policy analyses, see Robert and Zeckhauser (2011) and Hammitt (2009, 2013).

harms to those who are particularly vulnerable, perhaps because of factors beyond their control (such as age or heredity), including past injustices (such as discrimination)? Or are we primarily concerned with the distribution of wealth? How should policy makers address distribution? Should they use monetary compensation, changes in regulatory requirements, or other approaches? What should they do if a regulation substantially harms some members of a disadvantaged group but significantly benefits others? While the literature on these issues is rich and extensive, there is no consensus on how to address them. By itself, understanding likely regulatory impacts does not provide a guide to action. Such action requires thorny value judgments, which are subject to strong disagreement even among thoughtful observers.

In this paper, we discuss both positive and normative issues. We begin by reviewing recent regulatory analyses to determine the extent to which agencies assess the distribution of both costs and health-related benefits; we find that the agencies typically provide little or no information on distribution across population subgroups in these documents. We next explore possible explanations. First, we consider how different philosophic approaches to decision making affect the demand for information on distribution. Second, we explore pragmatic concerns, such as legal constraints and technical difficulties.

Two caveats before we continue. First, we focus on major federal environmental, health, and safety regulations that impose costs (at least initially) on industry to provide health-related benefits. We do not consider other types of regulations that have important distributional consequences, such as those that govern health insurance or the tax system. Second, we focus on the conduct and use of regulatory analysis. We do not investigate the full administrative record to determine whether and how distributional considerations enter into the decision-making process. While we presume that distributional concerns influence some decisions, the question we raise is whether the publicly-available analyses provide supporting information.

2.0 Current Analytic Requirements and Practices

Analysis of federal environmental, health, and safety regulations is influenced by both legislative and administrative requirements. The statutes that authorize such regulations may require that the agencies consider only certain types of requirements (such as standards based on the best available technology); they may also expand or (more often) circumscribe the extent to which benefit-cost analysis can be used in establishing these requirements. In some cases (such as the Safe Drinking Water Act), the statute may also raise distributional concerns, requiring that the agency consider the affordability of the requirements or develop standards that protect those who may be particularly vulnerable to certain types of hazards.

Regardless of the statutory language, administrative guidance requires that agencies conduct both benefit-cost and distributional analyses even if the regulatory decision cannot be based on the analytic results. Such analysis may be useful in guiding implementation or in identifying areas where legislative change is desirable. We briefly summarize related guidance, then report the results of our review of current practices.

2.1 Analytic Guidance

Under Executive Order 12866 (Clinton 1993), as supplemented by Executive Order 13563 (Obama 2011), agencies must assess the costs, benefits, and other impacts of significant regulations before they are promulgated, and must also assess alternatives if annual economic impacts are expected to equal or exceed \$100 million. The U.S. Office of Management and Budget (OMB) in the Executive Office of the President is responsible for reviewing the regulations and the accompanying analyses before they are finalized, and has issued implementing guidance in Circular A-4 (OMB 2003).

As part of its statement of regulatory philosophy, Executive Order 12866 notes that:

....in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity)...(Clinton 1993, p. 51735).

This language is reaffirmed in Obama's Executive Order 13563.

This construction is unusual. Conventionally, economists separate analysis of economic efficiency (that is, of national net benefits) from distributional analysis, as discussed in more detail below. In contrast, both executive orders include "distributive impacts" and "equity" as part of the net benefits agencies should seek to maximize, seemingly assuming that distribution would be part of the efficiency calculation.

The implementing guidance in OMB Circular A-4 follows the more traditional approach, separating the two types of analysis.³ It notes that:

Your regulatory analysis should provide a separate description of distributional effects (i.e., how both benefits and costs are distributed among sub-populations of particular concern) so that decision makers can properly consider them along with the effects on economic efficiency. (OMB 2003, p. 14)

The OMB Circular defines distributional effects broadly as including, for example, how regulatory impacts are divided across "income groups, race, sex, industrial sector, geography" as well as over time. It says very little about how to conduct this analysis, and does not indicate how distributional concerns should be weighed, deferring to decision makers.

While these two executive orders and the OMB Circular discuss distribution in broad terms, other executive orders (as well as some statutes) focus narrowly on particular impacts and subpopulations. In this paper, we are interested in the distribution of monetary costs and health benefits across population subgroups, which may be defined according to income, health status,

³ Older guidance in OMB Circular A-94 (1992) applies to government programs more generally (not solely to regulation), and also requires assessment of distributional effects when significant.

geographic location, minority status, or other characteristics. Existing requirements for assessing the distribution of compliance costs generally focus instead on particular types of organizations, such as small businesses and local governments.⁴ Those requirements that target distribution across groups typically focus on regulatory benefits, predominately health-risk reductions.

Two executive orders are particularly important in this context. Executive Order 13045, “Protection of Children From Environmental Health Risks and Safety Risks” (Clinton 1997), requires agencies to identify and address risks that may disproportionately affect children. For regulations subject to OMB review under Executive Order 12866, it indicates that agencies should assess these impacts and explain why a regulation is preferable to the alternatives. Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (Clinton 1994), requires agencies to identify and address “disproportionately high and adverse human health or environmental effects” on these groups in its regulatory and other activities. Each executive order establishes a task force or working group to develop more detailed guidance, largely delegating implementation to the agencies. Both are applicable to all types of policies (to the extent allowed by law), not only to regulation, and include requirements for research and for stakeholder involvement.

2.2 Analytic Practices

The requirements discussed above suggest that decision makers are interested in understanding how the impacts of regulations are distributed; however, the degree to which agencies assess this distribution has not been comprehensively evaluated. To address this deficiency, we examine the analyses for major environmental, health, and safety regulations reviewed by OMB in fiscal years (FYs) 2010 and 2011 (October 2009 through September 2011), as required by Executive Orders 12866 and 13563. Our approach allows us to consider a sufficiently large set of rules to see how practices vary across rules and across agencies, while not providing such a large set that detailed review becomes difficult. It also focuses our attention on practices under an administration that, in issuing Executive Order 13563, highlighted its commitment to considering regulations’ distributional impacts.

We focus on regulations that impose costs on industry so as to achieve health-risk reductions. The rationale for our interest in monetary costs seems self-evident: income is often the primary concern of those interested in distribution. While regulatory compliance costs are often initially borne by industry, they ultimately affect prices, wages, and profits--in turn affecting disposable income. The rationale for also considering health impacts in part reflects our interest in understanding the extent to which the distribution of costs and benefits is complementary or counterbalancing. Health improvements (particularly increased longevity)

⁴ In particular, two statutes focus on ensuring that specific types of organizations are not unduly burdened by regulation: (1) the Regulatory Flexibility Act addresses costs imposed on small private, nonprofit, and government entities, and (2) the Unfunded Mandates Reform Act addresses costs imposed on government units and on private entities of all types.

frequently dominate the quantifiable benefits of environmental, health, and safety regulations; they are typically their stated goals. Health is often viewed as a merit good that should be provided regardless of individual willingness to pay; as noted earlier, it is the focus of those executive orders most directly targeted on distribution, suggesting strong political interest.

To identify regulations for examination, we start with OMB's listings of the major final rules it reviewed that were accompanied by quantified estimates of both costs and benefits. There were 18 such rules in FY2010 (OMB 2011, Table 1-5a) and 12 in FY2011 (OMB 2012, Table 1-5a).⁵ Of these 30 rules, we eliminate 18 (nine from each year) that were not accompanied by estimates of health-risk reductions (regarding premature mortality, morbidity, or injury averted).⁶ We exclude these rules because, if the agency is unable to quantify the health benefits, it cannot quantify how these benefits are distributed.⁷

EPA air pollution rules dominate the set of 12 regulations that we review, both in terms of the number of rules and the magnitude of their costs and benefits (see Appendix A). Such rules also represent a significant fraction of all major regulations reviewed in other years (OMB 2011, OMB 2012). The EPA rules we review include three that establish National Emission Standards for Hazardous Air Pollutants (NESHAP) for particular sources; two that address the attainment of air quality standards in particular geographic areas: the National Ambient Air Quality Standards (NAAQS) and the cross-state rule; and two, jointly with the Department of Transportation (DOT), that address vehicle fuel economy. We also review four DOT rules designed to reduce various types of accidents. These are regulations requiring electronic recorders to track hours-of-service (and reduce fatigue) for commercial motor carrier drivers, curtain air bags to prevent ejection during motor vehicle crashes, control systems to prevent railroad accidents, and gas pipeline integrity systems to prevent explosions and fires. The remaining rule is from the Department of Labor (DOL) and addresses construction accidents associated with cranes and derricks. Although the effects of all these rules are national, each imposes direct costs on identified industries; and each reduces health or safety risks that affect identified groups (those living in areas with high air pollution levels, using particular transportation modes, or working in specific occupations).

⁵ These lists include only a small fraction of all regulations promulgated annually, but OMB believes that they account for the majority of the costs and benefits of the regulations subject to its review, given the relative magnitude of the impacts. These lists exclude "budgetary" rules that primarily transfer funds across different groups (generally from taxpayers to program beneficiaries) or that are promulgated by independent agencies not subject to OMB review.

⁶ Agencies do not consistently categorize costs and benefits. In some cases, cost-savings are counted as benefits; in others they are netted-out of the costs. For our purposes, we define costs as those impacts associated with the imposition of regulatory requirements, which generally relate to industry compliance costs. We define benefits as the environmental, health, and safety improvements that are the goal of the regulation (and hence the rationale for imposing the costs).

⁷ Such benefits are, in many cases, not estimated because the regulations do not directly address health. Several regulations primarily address administrative requirements, and some address appliance energy efficiency. In a few cases, the agency lacked the necessary data.

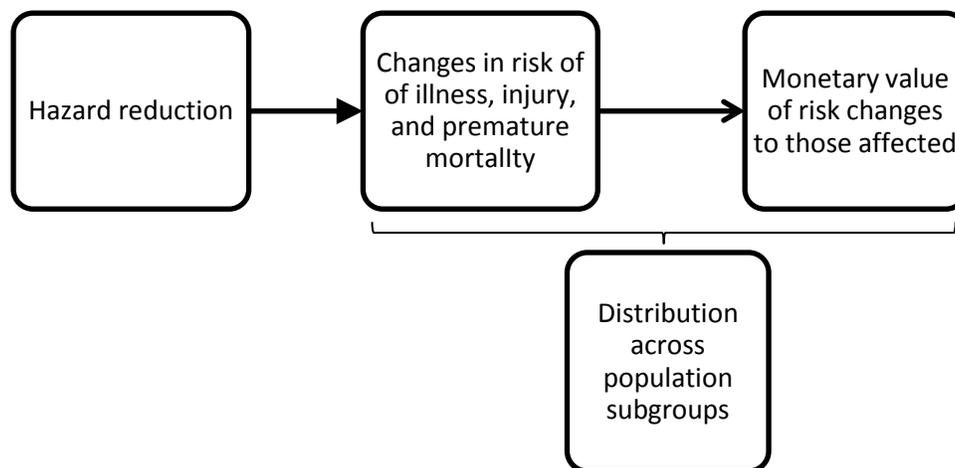
As Appendix A reports, the agencies estimate that the benefits of these rules exceed their costs nationally, with one exception. For the railroad control rule, DOT notes that it is required by statute to implement the requirements even though the estimated costs exceed the benefits (DOT 2010b). For some air pollution rules, the benefits exceed the costs by substantial multiples (more than an order of magnitude), while for other rules the difference is comparatively small.⁸ The agencies note that they were not able to quantify or monetize some impacts, particularly benefits such as ecological effects.

For each of the 12 regulations, we reviewed the preamble to the *Federal Register* notice and any separate regulatory impact analysis developed by the agency. Below, we summarize the information provided on the distribution of health benefits, compliance costs, and net benefits.

2.2.1 Distribution of Health Benefits

Calculating health-related benefits involves estimating both the number of statistical cases averted (the change in individual risk multiplied by the number of individuals affected) and the monetary value of these risk reductions. This process is illustrated in Figure 1. All the analyses we review include both components, but provide only limited information on distribution. When distribution is discussed, agencies focus on incidence. No attention is paid to whether or how the value of the risk reductions might vary across the affected groups.

Figure 1. Distribution of Health Risk Reductions



Incidence: In addition to the counts of the numbers of injuries or illnesses and deaths averted, each analysis provides some information on the characteristics of those affected. For example, EPA usually maps the geographic areas likely to experience air quality improvements. EPA also reports the age ranges (and pre-existing conditions in some cases) considered in the

⁸ Although the estimates of the costs and benefits of DOT’s pipeline safety rule are about equal, according to OMB (2011) which annualizes the impacts and rounds to the nearest \$100 million, in the underlying analysis DOT (2009b) reports that the rule is expected to produce positive net benefits.

epidemiological studies that underlie its incidence estimates, but it does not describe the age distribution or degree of health impairment across the affected population. DOT and DOL generally identify the transportation modes and/or occupations addressed as well as whether those affected are adults or also include children.

The language in OMB Circular A-4, as well as in the executive orders discussed earlier, suggests that decision makers are concerned about the extent to which those affected are low-income, belong to otherwise disadvantaged groups (such as minorities), or are particularly vulnerable to the regulated hazards (for example, due to health impairments which may or may not be related to age). We find that the agencies rarely quantify the distribution of health-risk reductions across these sorts of groupings. In most cases, they simply certify that the regulation is consistent with the executive orders regarding environmental justice and children's health because it does not adversely affect the health of minorities, low-income groups, or children.⁹

The exceptions are three EPA rules which include more detailed quantitative analyses. For a regulation addressing air emissions from Portland cement plants (EPA 2010c, EPA 2010d), the agency explores the demographic composition of those living in proximity to the polluting sources and finds that it is similar to that of the national population. For a regulation that addresses air pollutants that travel across state boundaries (EPA 2011a, EPA 2011b), EPA assesses the distribution of mortality-risk reductions across socioeconomic groups and finds that the rule provides significant benefits to susceptible and vulnerable populations, including low-income and minority groups. For a regulation governing sulfur dioxide emissions (EPA 2010e, 2010f), EPA assesses the effects on asthmatics of all ages and concludes that the rule is protective for all.

Monetary valuation: Once the likely number of averted cases is estimated, the second step is to estimate their monetary value. For the mortality-risk reductions that often dominate the benefit estimates, all the analyses apply population-average estimates of the value per statistical life (VSL). The VSL is calculated by dividing estimates of individual willingness to pay (WTP) for a small change in one's own mortality risk (in a defined period) by the size of the risk change; it is not the value of saving an individual's life with certainty. While both economic theory and empirical evidence suggest that WTP will vary depending on the characteristics of those affected (such as age or income) and of the risk itself (such as whether it involves significant morbidity prior to death or is perceived as involuntary or outside of the individual's control), the values currently applied generally fail to reflect any such variation (see Robinson and Hammitt 2011a, Robinson and Hammitt 2013).¹⁰ Because WTP generally increases with

⁹ These executive orders are not relevant to the DOL analysis nor to some DOT analyses because the regulations do not address environmental or children's health risks.

¹⁰ This practice in part reflects gaps and inconsistencies in the available empirical research, and in part reflects discomfort with applying varying values to different population groups. This discomfort in turn results largely from misperception of the VSL as the value that "the government" is placing on "saving" individuals' lives (Robinson 2007, Viscusi 2009, Cameron 2010), accompanied by the belief that all lives should be valued equally.

income (Hammitt and Robinson 2011), this use of population averages overstates the values held by poorer individuals and understates the values held by those who are wealthier.

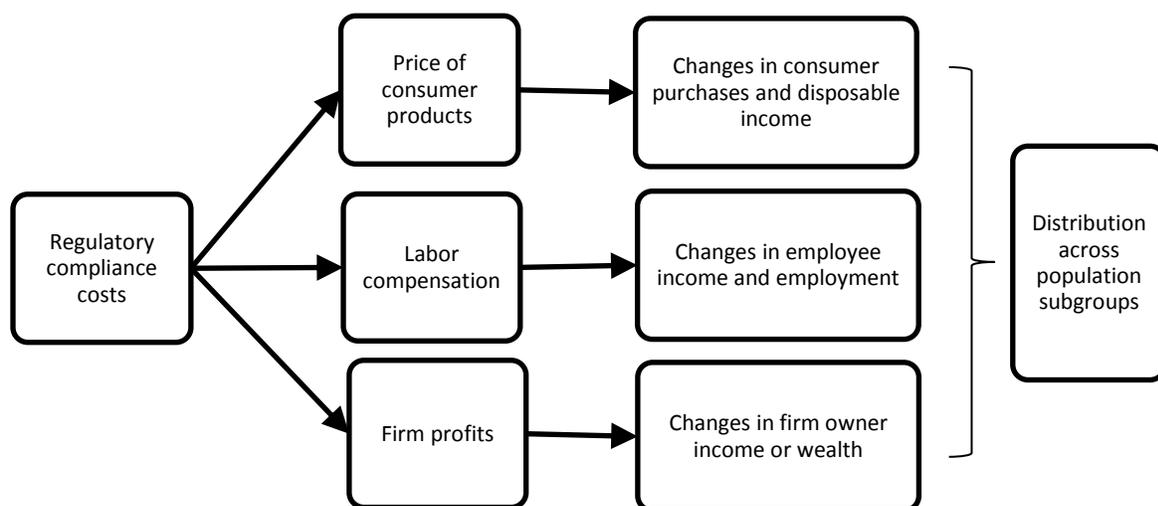
For nonfatal illnesses and injuries, relatively few empirical studies estimate WTP, and agencies often resort to proxy measures. EPA relies on cost-of-illness estimates for some health effects; DOT relies on monetized quality-adjusted life years (QALYs) and averted costs for nonfatal injuries. The construction, advantages, and limitations of these proxy measures are discussed in Robinson and Hammitt (2013) and elsewhere. For the purposes of distributional analysis, the most important point is that, to the extent that these estimates approximate WTP, they are again generally population averages (although they may vary by age). They do not reflect the values held by the affected groups for reductions in their own risks.

Thus, the approaches used do not allow us to determine how different groups value the risk reductions they are likely to receive. Without this information, we cannot determine whether the benefits that accrue to each group are worth more or less than the costs they incur.

2.2.2 Distribution of Compliance Costs

Assessing the distribution of regulatory costs is more complex. Typically, industry bears the direct costs of compliance, and the effects on individuals depend on how these costs are translated into changes in prices, wages, and profits.¹¹ The incidence of these costs may vary over time; firms generally have more flexibility to adjust in the long term than in the short term, when some production inputs are fixed. All of the analyses we review report industry costs. Few provide information on how these costs ultimately affect consumers in the aggregate, and none indicate how the impacts are distributed across population subgroups. We illustrate these relationships in Figure 2 and discuss them in more detail below.

Figure 2. Distribution of Compliance Costs



¹¹ Regulation may also affect the value of land or other real property; see, for example, Bento, Freedman, and Lang (2013) and Bento (2013).

Direct compliance costs: The analyses for all 12 rules address direct compliance costs, that is, the capital and operating expenditures required to meet the regulatory requirements, as well as any significant offsetting savings. These costs are generally reported both in total and on some sort of per unit basis, for example, as average costs per plant or per motor vehicle. For most of the rules we review, the agencies assess how these costs are distributed across different industries and firms and across for-profit, non-profit, and government entities, as well as how they affect small businesses and other small organizations.

Effects on prices: Information on behavioral responses is needed to determine the extent to which costs are absorbed by industry (through decreased wages or profits) or passed on to consumers through price increases; as noted earlier, these responses may vary over time. Some EPA analyses include partial equilibrium modeling that considers behavioral responses in the regulated industry, and in some cases in closely related industries, thus describing how costs will be distributed across consumers and producers in the aggregate (as reductions in consumer and producer surplus). The DOL analysis and some EPA analyses discuss how consumer responses to price changes might affect the extent to which regulatory costs are passed forward, but do not indicate what response is expected for the particular rule. The DOT analyses report only compliance costs, including offsetting savings in some cases. Only the two EPA-DOT fuel-economy rules estimate how the prices of consumer products may be affected, but they do not indicate how the price changes are distributed across different types of consumers. Thus, these analyses provide little or no information on how price changes will affect the disposable income of different groups.¹²

Effects on wages and employment: Generally, the analyses we review do not assess the effects of regulation on wages for those who continue to be employed in the affected industries or for those who change their employment. Some regulations address worker safety, but the agencies do not assess how wages are affected.¹³ EPA addresses job gains and losses for two rules: those governing emissions from Portland cement plants and emissions that travel across state boundaries. In both cases, EPA projects that some plants may close, but notes that whether these regulations will generate net gains or losses in employment is uncertain.¹⁴ EPA does not assess whether those affected are likely to transition quickly between jobs, nor does it estimate the effects on earnings. None of the analyses consider how the regulations affect wages across different income groups or other subpopulations.

Effects on profits: The analyses also do not estimate impacts on firm owners or shareholders. Some EPA analyses and the DOL analysis report total costs as a fraction of firm

¹² In some cases, the distributional effects of price changes induced by a regulation may be counterbalanced or alleviated by other programs, such as those that regulate prices or provide subsidies to consumers.

¹³ Studies of the trade-off between wages and job-related risks generally find that wages decline with increased safety; see, for example, Viscusi and Aldy (2003).

¹⁴ Increased employment may result, for example, if demand for the industry's product is unresponsive to price changes (inelastic) or if production requires additional labor (is more labor-intensive) once regulatory requirements are implemented; see Morgenstern et al. (2002) and Morgenstern (2013).

revenues, finding they are around 0.2 percent or less. However, as discussed above, the effect on profits is likely to be reduced through changes in prices and wages.¹⁵ No information is provided on the demographic characteristics of firm owners, although generally we expect that they are wealthier on average than any affected workers.

In summary, only some of the analyses we reviewed estimate aggregate or average changes in prices, wages, or profits. None assesses how these changes might be distributed across individuals in different groups. This leaves us ignorant about the distribution of costs and how it relates to the distribution of benefits.

2.2.3 Distribution of Net Benefits

Given the dearth of information on the distribution of benefits and costs, it is not possible to estimate the distribution of net benefits, despite the guidance in Executive Orders 12866 and 13563 and OMB Circular A-4. Are regulations regressive, as hypothesized by Fullerton (2009 and 2011)? Do regulations disproportionately affect groups defined by characteristics other than income, such as minority status or impaired health? We simply cannot know.

More specific requirements are more often and more easily addressed. In particular, the agencies certify that they comply with the environmental justice and children's health executive orders, if applicable. This certification is rarely based on detailed analysis. Agencies simply note that the regulations are designed to provide health improvements throughout the population and hence are not expected to harm the health of those the executive orders protect. Agencies largely ignore the requirements for broader distributional analysis, and OMB does not enforce those requirements. Net tallies of costs and benefits for different groups are simply not available.

3.0 Regulatory Philosophy

What can explain this lack of attention to distribution? One possibility is that the philosophical approach to regulation--that is, beliefs about the appropriate basis for decision making--affects the desire for information about how regulatory costs and benefits are distributed.

We identify three differing conceptions of the role of distribution in regulatory decisions, each of which is exemplified by some of the requirements discussed earlier. We first explore why we might be interested in distributional analysis even if regulatory decisions are based only on economic efficiency. We also address the traditional rationale for separating the analysis of

¹⁵ The effects of regulation on firms are more complex than can be discussed in this short summary. The conventional wisdom is that regulation always adversely affects profits; otherwise the firms would have undertaken the actions without the regulation. Porter and Van der Linde (1995) hypothesize that regulation may in fact benefit industry by encouraging innovation. This hypothesis is controversial, and various pathways by which it could occur have been described (see, for example, Ambec et al. 2013). Some industries may profit from regulation, such as those that manufacture equipment needed for regulatory compliance or produce other affected goods (such as corn to produce ethanol fuel). The theory of regulatory capture suggests that regulators may adopt rules that benefit the regulated industry, perhaps by increasing barriers to entry (see, for example, Carpenter and Moss 2013).

distributional impacts from the benefit-cost analysis. This conception seems somewhat consistent with the guidance in OMB Circular A-4, which advocates separating the two types of analysis, although OMB leaves it up to decision makers to determine whether and how to incorporate distributional concerns. Our second formulation builds on the first, but considers that the use of distributional information solely to provide assurance that subgroups of particular concern are not harmed. It captures the essence of the environmental justice and children's health executive orders (Executive Orders 12898 and 13045). Our third framework considers what information might be needed if decisions were to combine considerations of efficiency and distribution. It is exemplified by the executive orders that establish the general requirements for regulatory analysis and review (Executive Orders 12866 and 13563), which are unusual in that they treat distribution as a component of the net-benefit calculus. We conclude that the second conception appears most congruent with current practices.¹⁶

3.1 Efficiency Only

The conventional normative basis for using benefit-cost analysis in decision making begins with the Pareto Principle.¹⁷ That principle states that a policy is desirable if it makes at least one person better off and no one worse off. While this principle is attractive in theory, few policies meet this criterion. Almost any policy will harm at least some people, for example, by raising the prices they pay by more than the value of the benefits they receive. To address this limitation, variations were developed by Nicholas Kaldor (1939) and John Hicks (1940). These variations suggest that a policy is desirable if it makes the winners better off by an amount large enough that, in theory, they could compensate the losers, and alternatively, that it should be rejected if the losers could hypothetically compensate the winners for not pursuing the policy. These criteria do not demand that actual compensation take place or even that it be contemplated. Rather, they indicate that policies should not be implemented if costs exceed benefits. If more than one policy provides positive net benefits, the preferred choice is that which yields the greatest net benefits.

Benefit-cost analysis seeks to determine which policy option meets these criteria. Under the standard (neoclassical) model, economists often argue that decisions on government programs, such as the environmental, health, and safety regulations we consider, should be based solely on economic efficiency to ensure that resources are invested in those activities that maximize social welfare (Hylland and Zeckhauser 1979, Zeckhauser 1979, and Kaplow 2004). This line of argument notes that distributional goals can be achieved more comprehensively and effectively, and at a lower cost, by transferring money (through the tax system or programs that

¹⁶ As noted earlier, we recognize that regulatory decisions are often constrained by statute, which limits the extent to which decisions can be altered by any of these philosophies. Even if the analytic results do not affect the regulatory decision, they may identify areas where statutory reform is desirable and may guide implementation.

¹⁷ Other normative justifications are that benefit-cost analysis approximates a desired utilitarian calculus, that by requiring a comprehensive account of beneficial and harmful effects it helps avoid inconsistent attention to different effects, and that routine use of benefit-cost analysis for decision making will yield a long-term Pareto improvement, as individuals who lose on one policy decision may win on others (see Hammitt 2013).

provide supplementary income) rather than through policies focused on other goals such as improved health.¹⁸ Money transfers can be clearly targeted on the outcome (income) and the population (the poor) of concern, while other types of policies typically provide more heterogeneous benefits, such as reductions in air-pollution-related health and ecological risks, to more heterogeneous populations, such as both rich and poor individuals living in areas with high air pollution. The focus on economic efficiency is often described as maximizing the social welfare “pie,” slices of which can be redistributed if desired.

Within this framework, there may be little need for information on distribution. Advocates of this approach would argue that those interested in distribution should focus their efforts on reforming the tax and income-support systems rather than on environmental, health, or safety regulations. However, decision makers may still desire distributional information, for three reasons. First, they may be interested in the marginal impact of the regulation (or a set of regulations) on those at different income levels. If losses are great, they might investigate whether any compensating payments or adjustments in taxes or transfers are desirable. This concern may be best addressed by assessing the net effects of groups of regulations (over time as well as across agencies), rather than by considering regulations individually. Such analysis may find that the distributional effects are offsetting or complementary in ways that strengthen or weaken the rationale for compensating action. It would be administratively and politically costly to continually tweak the tax and income-support systems, or provide compensating payments, to address the effects of each regulation as it is promulgated.

Second, some may be interested in measuring and maximizing utility or well-being rather than simply economic efficiency as represented by unadjusted monetary values. Analysis based on the sum of the unweighted costs and benefits does not take into account the likelihood that the marginal utility of income may differ; that is, an incremental dollar is assumed to be worth more to a poor person than to a rich person. Adding weights that reflect the difference in marginal value would better approximate the effects of the regulation on total utility. Implementing such a utilitarian approach requires assessing distribution by income level to apply the weights. Although this approach has been implemented in some contexts, estimating the appropriate weights is challenging.¹⁹

Third, the least technical but most valuable rationale is that distributional analysis informs the debate.²⁰ It provides a factual basis for discussion with those who believe distribution should be considered, indicating both the magnitude of any distributional impacts and the trade-off between efficiency and distribution. It also aids the decision maker in recognizing concerns of political feasibility. If some groups will be hurt substantially, their fierce opposition and

¹⁸ See, for example, Zeckhauser (1971) for discussion of the optimal approach to income transfer. Such transfers are not costless; they involve administrative costs and discourage employment. Okun (1975) describes this as carrying money from the wealthy to the poor in a “leaky bucket.”

¹⁹ See HM Treasury (2003) for an example of this type of weighting and Hammitt (2013) for more discussion of the difficulties related to developing such weights.

²⁰ See Zeckhauser (1979) for more discussion of related issues.

perhaps defeat of a regulation should be anticipated. Where interest groups are powerful, distributional analysis may provide decision makers with the data they need to push back against demands for benefits that appear excessive.

The main drawback of considering only efficiency, for those who believe it provides the appropriate normative basis for regulatory decisionmaking, is that the tax and income-support systems are so difficult to reform to achieve distributional objectives. Some who support the efficiency-only model as the theoretical ideal may find that, despite the conceptual shortcomings, they favor one of the following two approaches because barriers to addressing redistribution elsewhere have thrust them into a second-best world.

3.2 Efficiency with Constraints

Our second stylized framework, like the first, relies on benefit-cost analysis to identify the most economically efficient option, and on the tax and income-support system to achieve income-related redistributive goals. However, it also addresses societal concerns about protecting certain groups against harm, consistent with the environmental justice and children's health executive orders. Both focus on health, and both identify groups of concern based on characteristics other than wealth (minorities, children), signaling the importance of distributional issues that are not entirely income-related and hence difficult to resolve satisfactorily through money transfers under the efficiency-only approach.

While appealing in concept, the approach exemplified by these executive orders is problematic from a societal perspective because it focuses on avoiding certain types of losses and ignores positive consequences. It is consistent with loss aversion (Kahneman and Tversky 1979, Tversky and Kahneman 1991), the tendency to weight losses disproportionately relative to gains, even when losses and gains are small.²¹ The baseline for loss aversion is often the current endowment or the status quo (Samuelson and Zeckhauser 1988, Kahneman et al. 1991, Knetsch 2010). Considering only losses ignores the existence of offsetting impacts. Any distributional effect involves both the "from" and "to" sides of the ledger; who benefits may be as important as who pays the costs. Loss aversion can also lead to inconsistent decisions. An evaluation of a proposed regulation could support a differing conclusion than an evaluation of an equivalent deregulatory proposal. If a program involves losses and gains along the same dimension (such as increases and decreases in risk), valuing them significantly differently can lead to illogical results such as intransitive rankings (see Robinson and Hammitt 2011b, Hammitt 2013).

Considering only whether groups of concern are protected from losses also does not provide information on combinations of impacts that may be of interest to decisionmakers. Where both the costs and benefits are concentrated among disadvantaged groups, decision

²¹ Loss aversion is illustrated by several studies that find that the amount individuals are willing to accept to give up a good they possess is much larger than what they are willing to pay for a good they do not own; see, for example, Horowitz and McConnell (2002).

makers may be more concerned about their relative magnitude than when impacts are concentrated among the advantaged. If the disadvantaged incur costs while benefits accrue to the advantaged, distribution may merit particular attention. These sorts of comparisons are not possible if analysts only certify that the health of identified groups is not harmed. Thus while the “efficiency with constraint” approach may appear attractive, in reality the analysis ignores important considerations and has serious flaws as a basis for policy decisions. Such an approach also does not resolve difficult normative issues related to how to incorporate the results in decisionmaking, as discussed under our third framework below.

3.3 Joint Consideration of Efficiency and Distribution

Our final stylized framework assumes that the decision maker wants to consider jointly the results of the benefit-cost and the distributional analyses. The two analyses could be conducted separately or combined; the key distinguishing feature is that the results of both would be weighed.

Within this framework, one option is to conduct a conventional benefit-cost analysis and complement it with a reasonably complete account of how the costs and benefits are distributed, consistent with the discussion in OMB Circular A-4 (2003). Policy makers could then consider these results when evaluating the merits of alternative decisions. As noted earlier, the benefits and costs received by different income groups could also be weighted by an estimate of the marginal utility of income of a representative member of each group, to determine which option maximizes utility (as opposed to efficiency).

A second option is to apply measures of inequality, such as a Gini coefficient, to characterize the distribution.²² Such measures can be used to describe the distribution of costs, benefits, and net benefits, indicating the extent to which a regulatory option promotes greater equality along each dimension.²³ A third option is to integrate more fully the analyses of distribution and efficiency. This could be accomplished by presenting the benefit-cost analysis both with and without distributional weights that reflect estimates of society’s preferences for distribution. Alternatively, social-welfare functions could be used to reflect social preferences for both the level and distribution of well-being; for example, as proposed by Adler (2012).

These approaches provide more information on the distribution of the effects throughout the population and, unlike traditional benefit-cost analyses, make evident the trade-offs between

²² Typically, a Gini coefficient is derived from a Lorenz curve, a cumulative distribution function that shows the inequality in the distribution of a variable (such as the fraction of costs borne by each fraction of the population). The Gini coefficient ranges from zero to one, where zero represents perfect equality and one represents maximum inequality. For example, a value of zero would result if each one percent of the population paid one percent of the costs; a value of one would result if a single individual bore all the costs. While the Gini coefficient is typically applied to income, it has also been applied to the distribution of mortality risks (see, for example, Levy et al. 2007).

²³ Adler (2013) provides a comprehensive review of inequality metrics and their advantages and limitations; Farrow (2011) provides an overview of alternative metrics used to describe the distribution of income; and Maguire and Sherrif (2011) discuss the application of these metrics to environmental justice concerns.

efficiency and distribution. One drawback is that they may be difficult to implement. Simply describing the distribution of the effects throughout the population may be challenging, as discussed later.

More fundamentally, it may be extremely difficult to achieve consensus on how both to measure and to weigh the desirability of the distribution, and on how to identify the groups across which the distribution would be assessed.²⁴ How do we determine whether the distributional effects are severe enough to warrant the efficiency losses associated with selecting an option that does not maximize net benefits? How harmful and widespread do the harms need to be? For example, what if a few poor people gain substantially, but many of the poor lose much smaller amounts, so that on net poor people gain? Should we choose an option that maximizes the average gain among the poor or one that minimizes the number of poor people harmed? What if an option imposes substantial costs on the poor, but significantly benefits those with health impairments? If we learn that a regulatory option disproportionately benefits poor people or significantly reduces inequality, but also imposes efficiency losses, how would we decide whether that option should be implemented? Should we measure gains and losses from the status quo, compared to some ideal distribution, or apply some conception of rights to good health, clean air, or income above the poverty level? What about the potentially counterbalancing or exacerbating effects of other regulations and policies? Improving the information available provides a starting point, but does not resolve difficult normative issues.

4.0 Pragmatic Concerns

Our review suggests that current practices are most consistent with our “efficiency with constraints” framework. However, these practices may reflect pragmatic concerns instead of, or in addition to, philosophic framing. Agencies may be concerned about the political implications of learning more about the distribution of impacts; they may believe that distributional effects are likely to be insignificant; or they may require more technical guidance as well as face significant data gaps and time and resource constraints.²⁵

4.1 Political Considerations

Our first hypothesis is that agency staff and leadership may be concerned about what more extensive distributional analyses might reveal. As noted earlier, the consideration of distribution raises difficult issues for decision makers. Agencies are concerned about their ability to promulgate timely regulations consistent with their statutory mandates. Distributional analyses

²⁴ An analogous problem arises in attempting to choose a discount rate for valuing future consequences, in which a key parameter measures the degree of inequality aversion between generations (see, for example, Gollier and Hammitt 2014).

²⁵ Information from regulatory agency staffs would be needed to determine the extent to which these hypotheses are true. However, the staff members we contacted were unwilling to speak on the record about these issues.

could delay and complicate an already difficult process by highlighting problems that the agency is unable to remedy and encouraging groups to oppose the regulation.

For example, suppose EPA assesses the full distribution of the costs and benefits of options for regulating an air pollutant across income quintiles. Assume further that EPA finds that the effects are regressive for any option that meets the statutory requirements--the costs imposed on poor people are greater than the value they place on the benefits they receive, while the rich benefit by more than the costs they pay. By law, EPA would still be required to issue the regulation. Yet EPA has no ability to compensate the poor for net damages either directly or through the tax code, and is exceedingly unlikely to get such capabilities in the foreseeable future. Poor people who do not object to air pollution regulations at present might if presented with such an analysis. Similar problems may result if agencies considered the distribution across other groups, whether defined by geographic location, health status, or other characteristics.

Thus distributional analysis could cause new groups to coalesce in opposition to the regulations, by identifying some who would be significantly harmed but were not previously aware of the regulation's impact. In accord with the principal finding of Prospect Theory (Kahneman and Tversky 1979, Tversky and Kahneman 1991), that individuals weigh gains much less than equivalent losses, those who disproportionately benefit may be less likely to become vocal advocates of the regulation, so the increased opposition may not be counterbalanced by increased support. Regulatory agencies may find it in their interest to "let sleeping dogs lie," particularly given their focus on their primary mission, such as protecting the environment in EPA's case.

These concerns may explain why OMB does not more strongly enforce the Executive Order 12866 and 13563 requirements for distributional analysis. OMB is part of the Executive Office of the President. Presumably, it is not in the president's political interest to require analysis that may identify problems associated with the regulations issued by agencies he (or some day, she) oversees. Sunlight may be the best disinfectant, as Brandeis (1913) once famously remarked, but identifying benefits and costs going to different groups may put such tallies under a magnifying glass. Adding magnification to sunlight can start fires.

4.2 Belief that Effects are Insignificant

A second hypothesis is that the lack of analysis reflects an unstated and unexamined assumption that the effects are small and hence not worthy of detailed analysis or consideration. For example, suppose that a regulation imposes net losses of \$10 on average for poor individuals and provides net gains of \$100 on average for wealthy individuals. The regulation would be considered regressive because the poor are harmed while the wealthy gain. However, the amounts are such a small fraction of income that decision makers may choose to ignore the distributional effect.

Examination of the overall effects of individual regulations may be interpreted by some as supporting this assumption, based on some simple thought-experiments. The rules subject to

the analytic requirements generally have annual economic impacts in excess of \$100 million. Even if we take \$1 billion in regulatory costs and divide these costs across all 115 million U.S. households, the average cost per household is less than \$10.²⁶ The number of premature deaths averted by the rules we review range from fewer than 10 to more than 13,000 annually. Dividing 13,000 by the 2.5 million U.S. deaths annually means that the rule would decrease deaths by about 0.5 percent in that year.²⁷ The number of deaths averted by most rules is significantly smaller, often in the range of 100 to 1,000 per year.

Even if these averages are small, they may hide concentrated effects on particular population groups. Thus, more analysis is needed to determine whether the distributional impact of individual regulations (or groups of regulations) is in fact insignificant.

4.3 Analytic Difficulties

Assessing the distribution of costs and benefits raises technical challenges. Almost no guidance is available on how to conduct such analyses, and few examples of distributional analysis of conventional regulations exist in the academic literature.²⁸ The government-wide guidance in OMB Circular A-4 (2003) indicates that the distribution should be described, but does not discuss the overall conceptual framework for conducting the analysis, the types of calculations or models that should be applied, or the data sources that would be most useful.

Implementation of these requirements is generally the responsibility of the individual regulatory agencies. EPA is the only federal agency that has developed comprehensive guidance for conducting regulatory analyses (EPA 2010a), perhaps because its regulations (particularly those addressing air pollution) comprise a large proportion of those subject to the executive-order requirements. EPA provides relatively detailed information on many issues, but provides no guidance on how to assess distributional impacts across population subgroups. Rather, it includes a placeholder for a chapter on “Environmental Justice, Children, and Other Distributional Considerations” which has not yet been published.

EPA has developed separate guidance on implementing the environmental justice and children’s health executive orders (EPA 2006, EPA 2010b), as has DOT (DOT 2012).²⁹ These guidelines are relatively general. They focus largely on the process for identifying, assessing, and addressing these concerns rather than on the specific analytic approaches that should be applied.

²⁶ Number of U.S. households (defined as those sharing a housing unit as their usual place of residence) from U.S. Census “Quick Facts:” <http://quickfacts.census.gov/qfd/states/00000.html>. Estimate is from the American Community Survey for 2007 to 2011.

²⁷ Number of U.S. deaths from Centers for Disease Control and Prevention “FastStats:” <http://www.cdc.gov/nchs/fastats/deaths.htm>.

²⁸ Available analyses of air pollution taxes and permits, such as Grainger and Kolstad (2010), provide a starting point for considering how the effects of conventional regulations could be assessed.

²⁹ EPA recently released new draft guidance (EPA 2013) on assessing environmental justice concerns in regulatory analysis, that provides more technical information but primarily addresses health-risk assessment.

Both focus on the incidence of health effects, not on economic valuation or comparison of benefits to costs.

Because regulatory costs can be shifted through market behavior, estimating their distribution across those in differing population subgroups (through changes in prices, wages, or profits) can be quite difficult and complex. In contrast, regulatory agencies appear to have much of the information needed to estimate the distribution of health effects. EPA is able to conduct relatively disaggregated analyses for its air pollution regulations, as illustrated by the analyses discussed earlier. Other agencies also appear to have access to some socio-demographic information, at least for fatalities. For example, the Bureau of Labor Statistics' Census of Fatal Occupational Injuries provides information on job-related risks, and the National Highway Traffic Safety Administration's Fatality Analysis Reporting System provides similar information for motor-vehicle accidents. While these databases do not report the income levels of those affected, they provide information on age and location, as well as on employment for job-related risks, which could be used to estimate income and perhaps other characteristics.

Although these data sources do not address the value that individuals in different population subgroups place on reducing these risks, available information on income elasticity could be used to at least roughly estimate the differences in values across income groups. Without valuation, we do not know whether the costs borne by different groups are less or more than they are willing to pay for the benefits they receive.

Constrained resources and staffing are another deterrent. Agencies may view conducting such analysis as less important than analyzing other regulatory impacts, providing services, or enforcing existing rules. Regulatory analyses are usually completed under tight schedules with limited staff and budgetary resources; paying more attention to distribution is likely to divert attention from assessing other important effects. Each of these factors poses significant challenges for the analysts involved.

5.0 Summary and Conclusions

U.S. government agencies are currently required to assess the distribution of the impacts of major environmental, health, and safety regulations. We find, however, that they pay little attention to this issue. To the extent that distribution is mentioned, the discussion is often limited to noting that the examined regulation will not impose disproportionate adverse health effects on children, minorities, or low-income groups.

This suggests that policymakers may believe that regulatory decisions should be based on economic efficiency (to the extent possible given statutory requirements), as long as the health of populations of concern is not directly harmed. We argue that this approach is problematic. It ignores health-related and other benefits as well as monetary costs, and does not indicate how the effects are distributed across more and less advantaged groups. As a result, it provides incomplete information on the trade-offs involved in decision making. Understanding the net distributional effects of a body of regulations is particularly important, given that it may be

preferable to address distributional goals through programs that are more clearly targeted on their achievement, particularly the tax and income-support systems.

The lack of attention to distribution may also reflect more pragmatic concerns. Federal agencies may have qualms about the consequences of conducting distributional analyses if they lack the statutory authority to address any perceived inequities, especially since such analysis may encourage opposition to regulations that the agency is legally obligated to implement. This lack of attention may also reflect unstated and unexamined assumptions that the distributional effects are small. In addition, analysts may need more detailed technical guidance and may face significant data gaps, as well as time and resource constraints.

This state of affairs is disturbing. It does not provide the data required if we wish to take distribution seriously; certifying that a regulation does not impose health-related harms on identified groups tells us little. The gap between the executive orders and actual practices is misleading, suggesting that the executive branch pays only lip service to distribution. The lack of guidance on how to conduct distributional analysis leaves well-intentioned analysts wandering in the wilderness. Clarity as to what types of analyses must be completed is required if analysts are to be able to fulfill their duties. Ultimately, this search for clarity and fidelity may reinforce the desirability of considering only efficiency in regulatory decisions, or it may suggest that more consideration of distribution is needed. Our current muddled middle ground is not acceptable.

A first step toward better understanding whether and how the distribution of regulatory costs and benefits should be assessed would be to conduct case studies of individual rules (or groups of rules), selecting a set that represents the range of rules subject to the analytic requirements. The case studies could test the feasibility of alternative analytic approaches, provide information on the types and magnitudes of the impacts, and identify the affected population subgroups. These case studies would facilitate better-informed debate on whether careful distributional analyses are both feasible and worthwhile. These studies could also be the starting point for a more thoughtful discussion of the difficult normative issues that such analyses raise.

At a minimum, conducting distributional analyses would make trade-offs more evident. Decision makers may choose the economically efficient regulatory option, knowing the likely significance of distributional effects, or may choose the regulation with the preferable distribution, knowing the magnitude of any efficiency loss. Even if we believe that regulatory decisions should be based solely on economic efficiency, information on distribution would allow us to engage in a better-informed debate with those who disagree, as well as to determine whether some sort of compensating action in the tax and income-support realm is desirable. Good regulatory decisions require positive analysis as a complement to sound normative judgment.

Appendix A: Major Regulations with Quantified Health Benefits (FY 2011-2012)

Rule	Annualized Costs and Benefits* (2001 dollars)	
	Costs	Benefits
U.S. Environmental Protection Agency		
Portland Cement Industry NESHAP (EPA 2010c, 2010d)	\$0.8 billion - \$0.9 billion	\$6.1 billion - \$16.3 billion
Sulfur Dioxide Primary NAAQS (EPA 2010e, 2010f)	\$0.7 billion (\$0.3 billion - \$2.0 billion)	\$10.5 billion (\$2.8 billion - \$38.6 billion)
Compression Ignition RICE NESHAP (EPA 2010g, 2010h)	\$0.3 billion	\$0.7 billion - \$1.9 billion
Spark Ignition RICE NESHAP (EPA 2010i, 2010j)	\$0.2 billion	\$0.4 billion - \$1.0 billion
Light-Duty Vehicle CAFE Standards (joint with DOT) (EPA 2010k, EPA and DOT 2010)	\$3.3 billion (\$1.7 billion - \$4.7 billion)	\$11.9 billion (\$3.9 billion - \$18.2 billion)
Cross-State Air Pollution (EPA 2011a, 2011b)	\$0.7 billion	\$20.5 billion - \$59.7 billion
Medium and Heavy-Duty Vehicle Fuel Economy Standards (joint with DOT) (EPA and DOT 2011a, 2011b, DOT 2011a)	\$0.5 billion (\$0.3 billion - \$0.5 billion)	\$2.6 billion (\$2.2 billion - \$2.6 billion)
U.S. Department of Transportation		
Hours of Service Recorders (DOT 2010a, 2010b)	\$0.1 billion	\$0.2 billion
Positive Train Control (DOT 2010c, 2010d)	\$0.7 billion (\$0.5 billion - \$1.3 billion)	<\$0.1billion
Pipeline Safety Distribution Integrity (DOT 2009a, 2009b)	\$0.1 billion	\$0.1 billion
Ejection Mitigation (DOT 2011b, 2011c)	\$0.4 billion (\$0.4 billion - \$1.4 billion)	\$1.5 billion (\$1.5 billion - \$2.4 billion)
U.S. Department of Labor		
Construction Cranes and Derricks (DOL 2010)	\$0.1 billion	\$0.2 billion
TOTAL, All rules	\$5.5 billion to \$12.3 billion	\$38.7 billion to \$141.3 billion

*These estimates reflect the distinctions between costs and benefits that are used in the individual analyses, which are not necessarily consistent. In particular, in some cases the benefits estimates include cost-savings as well as the value of reduced health and environmental risks.

Sources

Numbers in table are taken from:

U.S. Office of Management and Budget. 2011. *2011 Report to Congress on the Benefits and Costs of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities*, Table 1-5(a), pp. 25-26.

U.S. Office of Management and Budget. 2012. *2012 Report to Congress on the Benefits and Costs of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities*. Table 1-5(a), pp. 26-27.

Sources listed in first column are those consulted in developing the analysis reported in the main text.

Notes

CAFE = Corporate Average Fuel Economy

NAAQS = National Ambient Air Quality Standards

NESHAP = National Emission Standards for Hazardous Air Pollutants

RICE = Reciprocating Internal Combustion Engines

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