Complications Posed by Wealth Inequality for Environmental Policymaking

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Abstract:

We employ economic analysis to establish a role for reasonable environmental policy interventions to produce Pareto improvements, so that at least some people are better off without making others worse off. We acknowledge that there is some tension between this efficiency other goals of public policy, particularly addressing our growing wealth inequality. We recommend expanding Cost-Benefit Analysis (CBA), in which a cost-beneficial finding indicates that a proposed policy has the potential to bring us closer to the frontier of Pareto efficiency; the expansion should include an Environmental Justice (EJ) Analysis of the distribution of those costs and benefits across individuals to discern if the poor are actually made better off by the environmental policy intervention that is cost-beneficial for society on aggregate. We then review the battery of statutes charging EPA with environmental policymaking, all from the 1970s, to highlight their dearth of consideration for either efficiency or equity. Subsequent executive orders have tried to rectify these oversights, by prompting EPA to conduct CBA and EJ analyses, but we have some doubts about their effectiveness at this point. We present two case studies of EPA's economic analyses on proposed regulations: arsenic in drinking water and the hazards of lead paint in older residences. Drawing from these case studies and the latest literature, we present some unintended consequences of environmental policymaking vis-à-vis wealth inequality, including the perverse prospect of actually making the poor worse off. We conclude with some suggestions: environmental policy is not a good instrument for addressing wealth inequality, the distributional impacts of policy proposals should be more carefully analyzed (even if it results in delaying action until a sufficiently progressive policy can be designed), and we should seriously engage in an overhaul of the regulatory/statutory basis for environmental policymaking.

I. Introduction

Many policymakers are concerned with environmental protection, many are concerned with our growing wealth inequality; many are concerned with both and they are tempted to point a regulator's finger at our free market system. Champions of the free market are armed with powerful arguments, supported by the intellectual apparatus of economics, such as the first fundamental theorem of welfare economics which proves that a model free market (under a set of regularity conditions) will deliver Pareto efficient outcomes so that no one can be made better off without making someone else worse off (e.g. see Debreu 1959). The advocates for free markets routinely argue that we should simply organize our society around free markets (e.g. enforcing property rights, contracts, etc…) and let it achieve outcomes that are Pareto efficient. Opposing advocates for regulating away the wealth inequality and environmental impacts of the free market, even if growth ground to a halt. Despite any appeal of each world views, we find that they fall short in the real world for a couple reasons.

First, people highly value the economic growth generated by the efficient incentives in our free market system – they want better lives for themselves and their posterity. Yet, most people in a civilized society may not be [and perhaps should not be] satisfied with merely attaining a goal of Pareto efficiency. After all, Pareto efficiency simply means that no one in society can be made better off without making at least one person worse off, which technically includes such undesirable outcomes as a dictator [a la Arrow (1950)] commanding all of the world's wealth. Although that represents an extreme on the frontier of Pareto efficient outcomes, it illustrates the broader point that Pareto efficiency does nothing to guarantee equity, which continues to be held as a social objective for many who broadly support policies that move society along the Pareto frontier away from inequitable extremes. Those who value equity may even support policies that sacrifice some Pareto efficiency in exchange for gains in additional equity. Economists have astutely pointed out that, among heterogeneous people, there is no universal agreement on how to trade-off equity with efficiency in some social objective; hence, economists have largely resigned themselves to Pareto efficiency as a criterion for evaluating outcomes because it seems least objectionable – any Pareto improvement should receive unanimous support in a society with good will. Nevertheless, policy in the real world continues to be shaped by those who value reductions in wealth inequality, not just Pareto efficiency.

Second, economics' theorists can prove that market outcomes are Pareto efficient within idealized mathematical models; however these models are necessarily simplified and rely on assumptions that rarely hold in the real world, which is rife with a wide variety of market imperfections: incomplete information, transactions costs, and externalities. To avoid any confusion, we should be clear that we use the term externality to mean the formal concept of someone else's decision variable entering your constrained objective (i.e. their decisions affect you). Some externalities may not result in Pareto inefficiencies, such as when transactions costs are low enough for a market in that externality to exist; likewise, pecuniary externalities that work through the market mechanism may not be Pareto relevant, although their interaction with other market imperfections can make them Pareto-relevant (Greenwald and Stiglitz 1986). The environment, which is shared by definition, remains the canonical case of a Pareto relevant externality. Hence, we believe that there is considerable potential for an environmental policy that can produce Pareto improvements. However, not every environmental externality warrants a policy intervention – the reality of government failure can be worse for our welfare than the market's failure to deliver Pareto efficiency. Nonetheless, recognizing the reality of government failure does not justify ignoring market failure; some environmental policy interventions (such as removing lead from

gasoline) can produce Pareto improvements (net of the intervention's accompanying government failures).

If the role for environmental policy is solely to produce Pareto improvements, then the government should have a rigorous basis for determining whether proposed policies are Pareto improving. An economic analysis of all regulations with a significant economic impact has been required by executive order since the 1980s. Originally, that analysis strictly took the form of a Cost-Benefit Analysis (CBA) to identify whether a proposed policy could potentially generate a Pareto improvement; later variations augmented the CBA with some analysis of distributional effects (and hence are called Regulatory Impact Analysis to distinguish them from a pure CBA). The fundamentals of CBA, which forms the basis for environmental policy texts like Baumol and Oates (1975), are fairly well worked out in theory (e.g. see Hanley and Spash 1994) but are often quite controversial in practice (e.g. valuing ecosystems or valuing mortal risks). In theory, CBA works because it effectively simulates a market for [some rights to] an environmental aspect that otherwise does not exist due to prohibitively high transactions costs. A CBA should identify those who stand to gain from a proposed policy change (call them the buyers) and aggregate up their maximum willingness to pay for that policy change (these are called the benefits); likewise, a CBA should aggregate up the minimum willingness to accept (these are called the costs) for those who stand to lose from the proposed policy change (call them the sellers). If the benefits exceed the costs then the buyers of a "property right" over the status quo (those who stand to benefit) would compensate the sellers of that property right and a Pareto improvement would result.

In practice, the sellers in a CBA are rarely compensated by policymakers under a rationale provided by Kaldor (1939) and Hicks (1939), henceforth Kaldor-Hicks, who basically argued that: such gains and losses may just even out across many possible policy changes and (even if they do not even out) that any imbalance can be reconciled with income-based taxation policy – charging the wealthy net beneficiaries more because they benefit more from the entire set of policies.[1] Given what economists have learned about the influence that the wealthy wield over policymaking from the research in public choice theory (such as Buchanan 1987), we have a hard time placing much faith in the very visible hand of government taxation policy carefully balancing out such gains and losses of policy changes. Hence, imbalances in the distribution of net benefits of environmental policy are likely to persist. This imbalance can become a particularly perverse problem when those who benefit from environmental policy tend to be wealthy and the poor do not receive compensation for the forced sale of their property right. This becomes a reasonable rationale for performing an analysis of the distribution of an environmental policy's benefits and costs over particular subgroups of concern such as the poor (which has come to be called an environmental justice analysis). Hence, contemporary environmental policymakers can identify potential Pareto improvements but care must be taken that current practices in environmental policymaking do not exacerbate [growing] concerns over wealth inequality.

Despite how persuasive we find these arguments for the need for careful environmental policymaking vis-à-vis wealth inequality, we should note that they are not embraced by all experts. Starting from the intellectual groundwork of Noziak (1974) and extending the work of Coase (1960), some researchers have pushed for well-defined property rights and the derivative private market transactions as the preferred solution to the problem of environmental externalities (e.g. Anderson and Leal 2001).

[1] This rationale for income-based taxation amounts to a form of Lindahl tax where each person is charged their maximum Willingness to Pay for the entire set of government policies (e.g. see Foley 1970 for a formal treatment of Lindahl taxes).

Despite our own reservations over the practical extent to which we can rely exclusively on property rights to address externalities, we found some valuable lessons from those who argue in favor of using property rights instead of government's environmental policymaking. Property rights provide a more promising solution when the scope of the environmental externality is fairly local so that there are few parties concerned. More generally, environmental policy should be set at the most local level possible while still preserving the scope of the externality (which applies down to the most extreme type of local scope: 2 private parties, where a private contract is likely to be preferred over a local government intervention). This ideal, addressing an externality at the lowest level of government that still covers the scope, is known as federalism or subsidiarity. Economists make a persuasive argument for environmental federalism (e.g. see Oates 2002) by considering the alternative – when environmental policies are set at a level that is less local than necessitated by the externality's scope, then a Pareto improvement could be achieved by allowing those policies to be made at a more local level (for a more technical discussion, see Coffey 2013). Yet, there remain obstinate obstacles that constrain environmental policy from being made at a more local level. We have categorized these constraints into three classes: physical, policy, and political.

Physical constraints refer to the scope of the externality. For example, because regional air pollutants that cross state borders are interstate in scope, then regional air pollutants [such as sulfur dioxide (SO_2)] are better handled with national policy instead of state or local policy. Policy constraints refer to a lack of flexibility in the available policy instruments, which may have the crude impact of a broadsword instead of the precise impacts of a scalpel. For instance, the advent of tradable permits gave policymakers more control over the equitable distribution of outcomes than Pigouvian taxation (i.e. taxing an externality so that the perpetrator internalizes the damages that their actions unintentionally inflict upon others).[2] Political constraints refer to concerns of inequity and justice, such the goals of Environmental Justice and a uniform standard for public health across the entire country. Although we discuss the preceding two classes of constraints where appropriate, the latter class is our primary concern in this article. In particular, we explore the complications posed by wealth inequality for contemporary environmental policymaking and make some suggestions for improving that process.

II. Review of Major Environmental Statutes and Relevant Executive Orders

Decades of mounting environmental degradation culminated into an outpour of public concern in the 1960s, a decade with many major milestones such as the publication of Rachel Carson's *Silent Spring* and the ignition of Cleveland's Cuyahoga River. Congress first responded with passage of the National Environmental Protection Act (NEPA), signed into law on the first day of 1970, which required federal agencies to assess the environmental impact of their major actions. The rest of the 1970s witnessed a sequence of landmark environmental statutes in which Congress charged the newly formed Environmental Protection Agency (EPA) with broad powers in environmental policymaking. Many, if not most, of these environmental statutes do not evidence much regard for concepts of efficiency, Pareto or otherwise; they also lacked any special consideration for the welfare of the poor.

[2] Although the revenue generated by a Pigouvian tax could be allocated towards the losers of the policy, this was not often done in practice (in part, due to concerns over rent-seeking and in part due to the larger process by which tax revenue is allocated). Grandfathering permits made it much easier for environmental policymakers to have a direct lever over the distribution of outcomes.

Concerns over the efficiency of environmental policy and the potential for disproportionate impacts on the poor did not take the force of law until the issue of executive orders in the 1980s and early 1990s (under Reagan and Clinton, respectively). As we shall soon discuss in greater detail, Reagan issued the Executive Orders that made CBA a standard practice for regulations (with a significant impact); however, consideration of EJ did not appear until a Clinton Executive Order in the early 1990s.[3] In the understandable rush to address pressing matters of pollution on the land and in the air and water prior to these Executive Orders, less than optimal results (in terms of economic efficiency, not to mention EJ) were obtained.

A. Clean Air Act (CAA)

The Clean Air Act (CAA)[4] was passed in 1970 and has been amended a couple of times since then (most notably in 1990). The CAA requires that EPA set *National* Ambient Air Quality Standards (NAAQS) (emphasis added) for various criteria pollutants such as lead, carbon monoxide, ozone, and nitrogen oxide (6 in all) with each having a primary human health standard and, for some, a secondary standard to protect public welfare. The NAAQS are national and apply throughout the country, although State Implementation Plans (SIPs) are implemented locally in areas of nonattainment of the standards. States have the prerogative of choosing different approaches as long as their SIPs ultimately achieve attainment of the standards over time.

But the salient point is that, pursuant to the letter of the CAA, costs of implementation may *not* be considered by the EPA in setting the NAAQS in the first place. This reading of the law was confirmed in a 9-0 opinion, written by Justice Scalia, a noted member of the "textualist" school of legal interpretation, in the Supreme Court case, *Whitman v. American Trucking Ass'ns* (2001).[5] Recall, too, that this case was decided years after President Reagan's Executive Order mandating CBA for rulemakings which still applies when not inconsistent with the law. According to this Supreme Court ruling, the letter of the CAA law forbids explicit use of CBA in determining air quality standards. A CBA is still conducted to evaluate the policy, in accordance to Reagan's Executive Order, but that CBA is not to be used to determine the policy. Indeed, much of the implementation provisions of many parts of the CAA must be subject to CBA and often pass with flying colors. But NAAQS is where the whole process starts and setting it drives costs throughout the process.

Indeed, one criticism of cost-free NAAQS is that it is an obstacle to candid public debate about air quality goals because the EPA cannot explicitly discuss its considerations of costs, even though it must of necessity think about costs (Landy et al. 1990).

B. Clean Water Act (CWA)

[3] There was some lower-level concern over EJ in the 1980s. William Reilly, a former EPA Administrator, has relayed a caution on EJ from the thoughtful Senator Daniel Patrick Moynihan ("above all, don't allow your agency to be transported by middle class enthusiasms") on multiple occasions within earshot of one of this paper's authors.
[4] 40 U.S.C. Sections 7401 et seq.

Congress passed the Clean Water Act (CWA)[6] in 1972. The essence of the CWA is its prohibition of the discharge of a pollutant into the waters of the U.S. from any point source (imagine the traditional pipe protruding into the water) except when sanctioned in a permit. The law imposes categorical, technology-based effluent guidelines, or limits, on industrial point-source dischargers. The technology-based requirement for large centralized publicly-owned treatment works (POTWs), as developed by EPA, is secondary treatment which requires that bacteria be used to consume the organic parts of the waste stream on top of primary treatment which utilizes screening and sedimentation tanks. If, after application of these standards, the waters did not meet water quality standards, the state then imposes water-quality-based standards on top of the technology-based requirements.

Keep in mind that these technology-based standards are applied to every discharge according to their respective industrial or municipal category regardless of the quality of its receiving water. Congress followed Nike on this subject: "Just do it!" This exuberance of Congress was a reaction to public outcry over the failure of water quality standards set under prior law, which often resulted in "paralysis by analysis." This may have been a sound judgment at a time of widespread outrage over burning rivers and dying lakes (e.g., Lake Erie), but it did impose significant costs.

As a result, wastewater systems faced exceedingly large investments in improving their sewage treatment technology. To alleviate sticker-shock over this cost, initial construction grants were provided to subsidize this growth in sewage treatment infrastructure. Researchers have subsequently judged this program to have promoted overinvestment and excess capacity (Harrington & Nelson, 2006). That tradition, of requiring wastewater treatment plants to heavily invest in capital-intensive solutions in order to address water quality issues, continues today. Reductions in phosphorus and nitrogen loading via reductions in agricultural runoff (i.e. paying farmers to leave riparian buffers fallow so that they can absorb excess nutrients) are surely orders of magnitude cheaper than further treating more phosphorus and nitrogen out of wastewater (Fisher-Vanden and Olmstead 2013).

This is not to criticize the decisions made in 1972 by Congress but only to offer a historical explanation of how these requirements contributed to the growing concerns with affordability and environmental justice particularly in older, poorer central cities.

The CWA does give EPA some flexibility in moderating demands placed on POTWs by Combined Sewer Overflow (CSO) regulation when EPA detects a significant affordability issue for the local community. EPA determines affordability through a semi-quantitative formula but there is a critical threshold: wastewater bills should be no more than 2% of Median Household Income (MHI). The nation's mayors are very agitated over affordability issues under the CWA given that so many of their cities are the homes to low-income minority communities and senior citizens. The primary focus for these concerns revolve around "urban wet weather" issues, which includes combined sewer overflows but also extends to issues such as the over-hanging cost of POTWs mandated by the CWA.

Hence, the 1972 CWA was designed around achieving what is technically feasible, regardless of its costs. Beyond these technology-based standards, a redeeming feature of the CWA is that the power of setting additional water quality standards lies with the states (subject to EPA oversight). The CWA is a 42-year old statute which regulates only point sources in what is basically a traditional command-and-control

[6] 33 U.S.C. Sections 1251 et seq. This law was formerly called the Federal Water Pollution Control Act Amendments.

method. However, only recently have cost considerations come to the forefront (e.g. with phosphorus and nitrogen nutrient loadings). Over the decades EPA has attempted, with only minor success, to mitigate the cost-ineffectiveness of the Clean Water Act through variances, watershed-based permitting, and water quality trading as well as deferring to the state's lead in setting water quality standards except where citizens' suits make that impossible (Fisher-Vanden and Olmstead 2013).

C. Safe Drinking Water Act (SDWA)

Enacted in 1974, amended in 1986 and 1996, the Safe Drinking Water Act (SDWA)[7] is the primary federal law protecting public water supplies from contamination. SDWA nationalized drinking water quality by setting uniform standards that apply across the nation for various contaminants. Its standard setting process is sometimes described as "feasibility-limited" (Percival et al. 2013) which is defined as "feasible with the use of the best technology, treatment techniques and other means…after examination of efficacy under field conditions and not solely laboratory conditions (taking costs into consideration)."

The reference to cost consideration is fine as far as it goes, but the architecture of the standards development process places cost considerations at a very low point on the totem pole relative to human health concerns. After EPA does various "occurrence" studies, evaluates the potential human exposure and risks, and, *inter alia,* evaluates the availability and costs of treatment techniques that can be used to remove a contaminant, it sets a nonenforceable maximum contaminant level goal (MCLG), with an adequate margin of safety, often at zero. This MCLG is not based on the availability or costs of treatment technologies and may not, therefore, be "feasible." Thereafter, the agency then sets an enforceable standard, the maximum contaminant level (MCL) as close to the MCLG as feasible usually designed to be affordable for the 80 percent of the population served by large community water systems (Tiemann 2010).

According to Mary Tiemann of the Congressional Research Service (CRS), "In 1996, …Congress further revised the act to require EPA, when proposing a standard, to publish a determination as to whether or not the benefits of a proposed standard justify the costs. If EPA determines that the benefits do not justify the costs, EPA, in certain cases, may promulgate a standard that is less stringent than the feasible level and that 'maximizes health risk reduction benefits at a cost that is justified by the benefits.' EPA used this authority to establish new standards for arsenic and radium."

The 1996 amendments of the Safe Drinking Water Act (SDWA) also allow each state to grant variances to [small] public water systems that cannot afford to comply with a drinking water regulation, if EPA finds that there is no affordable treatment technology for systems of that size and type of source water. EPA determines affordability through a threshold similar to the CWA – drinking water bills should not exceed 2.5% percent of the median household income (MHI). The drinking water industry, which is primarily composed systems owned by the local municipal government or perhaps of a not-for-profit, has long been skeptical of this affordability standard and has recently raised concerns that EPA needs to revise this standard for drinking water just as it is considering revisions for wastewater.

"For some, though, water may already be too expensive," says David LaFrance, Executive Director of the American Water Works Association (AWWA). "It may not be because the price exceeds the value for

[7] 42 U.S.C. Section 300g-1 et seq.

these individuals, but rather that they cannot afford what they need—even if they value it." LaFrance applauds recent efforts by EPA to work with the U.S. Conference of Mayors and the Water Environment Federation on affordability concerns under the CWA. He specifically references the need "to move away from measuring affordability based primarily on median household income" (LaFrance 2013).

Hence, like the CWA, SDWA was designed around setting standards that are technically feasible. The 1996 amendments enabled EPA to (temporarily) set a weaker than feasible standard if the technically feasible standard does not pass a CBA. Unlike the CWA, all SDWA standards are set at the national level with little devolution to lower levels of governments (states are allowed to set stricter drinking water regulations). Affordability variances and exemptions (although those are rarely, if ever, granted) to SDWA standards can be granted by a state to individual utilities if EPA determines that meeting the standard is unaffordable for them. This mechanism is far from determining a local level of water quality that is optimal given its costs and benefits.[8]

D. Other Major Environmental Protection Acts (TSCA, RCRA, and CERCLA)

Having already authorized EPA to regulate our air with the CAA, as well as our waters with the CWA and the SDWA, 1976 witnessed Congress passing both the Resource Conservation and Recovery Act (RCRA) to provide some protection for our lands from the perceived threat of being filled with our waste and the Toxic Substances Control Act (TSCA) to regulate chemicals (new and existing). Despite some notable environmental improvements due to TSCA and RCRA, policymakers soon became convinced that they were insufficiently comprehensive. In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[9], which came to be known as the Superfund law. We are not aware of any reference to efficiency or equity in TSCA, RCRA, or CERCLA.

Hamilton and Viscusi (1999) conducted a major study of the effects of CERCLA. They find that EPA spent $2.2 billion at the 145 sites analyzed for the period 1991-1992. Of that total, $1.4 billion was spent at large sites "to reduce cancer at a cost above $100 million per cancer case averted." Hamilton and Viscusi (1999) showed that CBA (and risk assessment, which is an input to CBA) in hazardous waste site selection and remediation decisions would yield substantial savings since so much money had been spent on sites posing relatively little population risk. Of course, even placing a contaminated site on the National Priority List, a pre-condition for cleaning it up under Superfund, is impacted by community pressure which the authors of the study believed worked against the interests of members of poor and minority communities. They also conclude that CBA "may reduce environmental inequities by reducing the role of constituent pressure in remediation and by focusing attention high health risks, which often occur in minority communities." This implies that employing CBA could actually benefit both efficiency and equity concerns since poor and minority populations were more densely concentrated around sites passing the CBA test than they were on average for the entire sample.

E. Executive Orders 12291, 12498, 12866, and 12563 (Cost Benefit Analysis)

[8] Our concerns here are not new. See Dinan, Cropper, and Portney (1999) for an example of an earlier discussion of the inefficiency of SDWA's regulatory standards for drinking water (a local [quasi-]public good) being set as uniform for the entire nation for the entire nation.

[9] 42 U.S.C. Section 9601 et seq.

Every president since Richard Nixon, who oversaw the formation of the EPA, has established procedures for executive review of agency regulation (Dudley 2005). However, 1982 became a watershed year when President Ronald Reagan mandated that agencies conduct a benefit-cost analysis of regulations before publication by the Office of Management & Budget (OMB) under Executive Order 12291. In 1986, Reagan's Executive Order 12498 further required "agencies to submit an annual regulatory plan and to adhere to cost-benefit principles" (Hahn and Sunstein 2002). Subsequent Presidents (George H.W. Bush, Bill Clinton, George W. Bush, and Barack Obama) have pretty much continued the practice, with the Democrats propagating their tweaks in Executive Order 12866 of 1993 and Executive Order 13563 of 2011.

The current iteration of OMB review requires federal agencies to submit significant rulemaking actions of $100 million or greater in costs to OMB's Office of Information and Regulatory Affairs (OIRA) for review prior to publication in the Federal Register. Each agency must publish a summary of its rulemaking plans with current status, again, in the Federal Register at the end of April and October. The required regulatory analysis must include a statement of need, an assessment of alternative regulatory approaches, and, of course, a CBA.

Within allowable parameters, OIRA can have great impact on the final shape of regulations. Yet, an executive order does not trump statutory mandates, and many environmental regulations are being issued under court order pursuant to citizen suits authorized by law.[10] Despite amazing bipartisan consensus on the character of the relevant executive orders and the efficacy of CBA, there may lurk some fundamental problem that is not remedial through executive action. Christopher DeMuth, head of OIRA from 1981-1984, contends that the problem "is the growth of the size, scope, and power of administrative regulation due to the increasing delegation of lawmaking authority from Congress to the Executive Branch"; he believes that the result of thirty years of "skirmishing" between the White House (OMB and OIRA) and the regulatory agencies have been "only marginal improvements in regulatory policy" (DeMuth 2011). In other words, more rules and more costs are being borne despite OIRA's efforts and thus the proliferation of performing CBAs has not been as fruitful as intended.

F. Executive Order 12898 (Environmental Justice)

The environmental justice (EJ) movement was born out of concern of local activists that local undesirable land uses (LULUs) were more likely to be sited in impoverished communities populated by the poor; subsequent work by researchers has established this as a stylized fact (Banzhaf 2012). The EJ movement developed into a focus on the disproportionate exposure to environmental risk of poor and minority populations because those communities are more vulnerable. One explanation for this is a story rooted in old fashioned racial discrimination, which should be illegal (e.g. Fair Housing Act). Hence, our focus is on the competing explanations that are all tied to the market mechanism – the poor tend to live in locations with lower environmental quality (and minorities are more likely to be poor). In fairness, an incomplete consideration of the poor is a repercussion of our current approach to policymaking; classic CBA has two deleterious effects on the importance of whether the poor are made better off by a policy. First, individuals' benefits and costs (measured as wiliness to pay and willingness to accept,

[10] See Butler and Harris (2014) for a discussion of the implications of these suits driving environmental policymaking.

respectively) are both increasing in income and thus the effects on poor are implicitly down-weighted. Second, individuals' benefits and costs are hidden in the aggregate figures used in a CBA.

While there has been little to no statutory response to the EJ movement, the federal government did respond in the form of President Clinton's 1994 Executive Order 12898[11] which directs each federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low-income populations. Under the George W. Bush administration, EJ was drastically deprioritized even though Executive Order 12898 was never formally rescinded. As a result, EPA struggled to effectively implement this executive order, even drawing a rebuke in 2005 from the Government Accountability Office that it had failed to take environmental justice considerations adequately into account when developing a rule to reduce sulfur content of gasoline (Percival et al, 2013). EJ reemerged as a top priority within EPA when Barak Obama appointed Lisa Jackson, an EJ enthusiast, to be the EPA administrator. Since then, EPA has made some positive steps towards incorporating a rigorous EJ Analysis into every Economic Analysis with tentative suggestions made in a recent draft technical guidance (see US Environmental Protection Agency 2013).

III. Case Studies from EPA's Economic Analyses of Environmental Policies

It is well documented that EPA has been rather prolific in promulgating environmental regulations, especially those with a significant economic impact exceeding the OIRA threshold of $100M; EPA's regulations tend to have exceedingly long RIAs to cover the rules' complexities (often using custom formats that are tailored to the rules), which has the unfortunate side-effect of raising the cost of conducting a broad review of all of EPA's recent regulations (Al-Ubaydli and McLaughlin 2012). Instead, we present two case studies of two major regulations that are recent enough to be salient but distant enough to enable a sober assessment armed with the clarity of hindsight.[12] For more case studies of particular environmental regulations, in which EPA's analyses paid inadequate attention to [unintended] distributional consequences, see a recent review by Robinson et al. (2014).

A. Arsenic in Drinking Water

Infamous as a poison, arsenic is regulated by EPA under the Safe Drinking Water Act (SDWA) because it is a [Class A] human carcinogen, known to cause at least 3 different types of cancer: bladder, lung, and liver.[13] The proposed rule was a revision of the existing standard for arsenic, tightening the Maximum Contaminant Level (MCL) from 50 μg/L down to 10 μg/ to be closer to the MCLG (Maximum

[11] 59 Fed. Reg. 7,629 (1994).

[12] We note that these two regulations are also interesting because of their appearance at "midnight": December 2000, which was the last month of the last year of the Clinton Administration after election outcomes indicated that Clinton's successor would come from the other party (for more on the phenomenon of midnight regulations, see McLaughlin 2011). Also, this date (December 2000) occurred just prior to the second stint of one of this paper's authors at EPA as a senior policymaker (Assistant Administrator for Water); the first stint included the midnight of George H. W. Bush Administration.

[13] The basis of this paragraph is our professional knowledge gained by our own personal experiences working for EPA; however, all of this information can be found in the RIA for Arsenic in drinking water, see U.S. Environmental Protection Agency (2000a).

Contaminant Level Goal) of 0. It also broadened the set of systems to which the rule applied to include non-transient non-community water systems in addition to community water systems.[14] Also, the proposed revision altered the monitoring requirements to make them more in line with EPA's Standard Monitoring Framework (SMF).[15]

The RIA relied on a boilerplate rationale for regulating contaminants in drinking water systems: water utilities are natural monopolies (albeit usually not for profit) and they can use their monopoly power to provide sub-optimal drinking water quality because of the high information requirements and transaction costs to having adequate public understanding of health risks of contaminated drinking water. For candidate MCLs of 3, 5, 10 and 20 μg/L, the Regulatory Impact Analysis followed EPA's standard simulation procedure for evaluating drinking water regulations. EPA examined the monitoring costs (collecting samples from entry points into the distribution system for treated water and then having those samples tested by a capable laboratory) and compliance costs (based on a best professional judgment that various systems would choose different treatment technologies).[16] This is repeated for all of the nation's drinking water systems (drawn from the Safe Drinking Water Information System with characteristics resembling EPA's Community Water System Survey) that are predicted to have sufficient arsenic occurrence to exceed the MCL.[17] For these same systems, EPA predicted the health benefits generated by the expected number of cancer illness cases avoided, giving special consideration to sensitive subpopulations.[18]

Although an MCL of 3 μg/L was technologically feasible, EPA ultimately relented in response to the exigency of small water systems concerned about the affordability of such a strict standard.[19] EPA predicted that the rule would reduce 20 to 30 fatal cancer cases across the nation per year (with an even wider margin of error according to critics), which yielded $140M to $198M per year in benefits when multiplied by EPA's number for the Value of a Statistical Life (VSL). The expected total cost was $206M per year, which is not cost-beneficial on aggregate but EPA argued that non-quantified benefits where believed to be sufficient to tip the scale. Also, those costs were distributed quite unevenly across households due to the scale economies of the water systems that serve them – less than $1 per year for

[14] Community Water Systems (CWS) are defined as systems that provide piped water to at least 25 people (or at least 15 service connections) year-round. Non-transient non-community water systems are public water systems not defined as a CWS and that regularly serve at least 25 of the same people for at least six months of the year.

[15] The SMF is supposed to simplify monitoring plans and synchronize monitoring schedules without rolling back public health protection. In this case, quarterly monitoring could still be triggered if the running annual average at the standard monitoring frequency exceeded the MCL, as could a monitoring waiver of 9 years after 3 rounds of monitoring (with detection limits below 10 μg/L).

[16] The following treatment technologies were considered to be affordable: anion exchange, activated alumina (AA), reverse osmosis (RO), modified coagulation/filtration, modified lime softening, and Oxidation/filtration. Each of these can have high costs, both in up-front capital and in on-going O&M; the costs tend to exhibit strong increasing returns to scale so that compliance is relatively costlier for the thousands of small systems that each serve relatively few people.

[17] The occurrence of Arsenic was primarily estimated from EPA's in-house data sources, such as the National Inorganic and Radionuclide Survey (NIRS).

[18] The basis of this paragraph is our professional knowledge gained by our own personal experiences working for EPA; however, all of this information can be found in the RIA for Arsenic in drinking water, see U.S. Environmental Protection Agency 2000a.

[19] See Sunstein (2002) or Oates (2006) for an overview of the events around the adoption of this stricter standard for arsenic, as well as a similar discussion of the details that appear in this paragraph.

very large systems but almost $350 per year for very small systems (which would dwarf any benefits that they might accrue from the rule). Hence, EPA offered financial assistance to smaller systems and increased the flexibility of the rule by allowing states to grant variances to small water systems. Beyond such affordability concerns, EPA determined that there were no disproportionate effects that would raise EJ concerns.

Despite the controversy reflected in the unfavorable cost-benefit metrics for the arsenic rule revision, it enjoyed solid support from most Americans.[20] The source for this support may be that it captured the imagination – arsenic poisoning otherwise pseudo-pure drinking water – or it may stem from applying the precautionary principle to the cloud of uncertainty shrouding EPA's Economic Analysis. Professor Cass Sunstein, a former OMB official in the Obama administration, has highlighted that wide range of uncertainty: plausible alternative assumptions could lead to cost-benefit analyses findings that the arsenic regulation has net costs of $210 million or net benefits of $3.15 billion, depending on the scenario (Sunstein 2002).

Yet, even if the arsenic rule was found to be cost-beneficial on aggregate, a mayor of a small town in New Mexico with a low-income constituency, who can barely finance schools, police, fire or the local health clinic may, legitimately, rank arsenic contamination lower on his personal hierarchy than does the SDWA. For a small town of 500 residents, cutting arsenic levels in half (from 20 to 10 parts per billion) from their drinking water was expected to cost a bit more than $162 per resident per year but provide relatively miniscule benefits; a back-of-the-envelope calculation, using the figures in the RIA, suggests that the risk reduction would extend their life expectancy by less than 3 hours but a minimum wage earner could only earn less than $16 in that same time (so that they would need to work 30 more hours per year for the rest of their lives in order to pay for the EPA mandated benefit that would extend their lives by a total of 3 hours, which could be argued as equivalent to taking 897 hours away from the life of a 40 year old expected to work until she dies at age 70).[21] Certainly, extreme exposure such as found in the wells in Bangladesh present serious and even catastrophic threats. But one would be hard pressed to convince our mayor in New Mexico that this is the case with her town's water, given EPA's own evidence from samples taken across the country. Even a feasibility-limited standard, if elevated to the level of a national standard applicable to all places and all socio-economic circumstances, will create serious predicaments such as those this hypothetical local official confronts.[22]

[20] See Sunstein (2002) for a discussion of the public outcry over arsenic.

[21] Exhibit B-3, in the RIA, gives EPA's bounds on the after-treatment cancer risks as between 0.63×10^{-4} and 2.99×10^{-4} for an MCL of 10. Because the risk equation equals the arsenic concentration times some scaling factor, cutting the concentration from 20 to 10 ppb reduces risk by between 0.63×10^{-4} and 2.99×10^{-4}. Conservatively assuming that all such cancer cases are fatal and that the hazard rate for cancer is simple, then that avoided risk is the number of years that life expectancy has been extended by the treatment. Multiplying that by the number of hours in a year yields the results of our back of the envelop calculation (which also made use of the $5.15 per hour level for minimum wage at that time). To be fair, this back-of-the-envelope calculation implicitly uses a different methodology for valuing the benefits of the reduced risk than used by the RIA.

[22] In contrast with our argument, the RIA does have a paragraph devoted to dismissing any EJ concerns over Arsenic: "The Agency has considered environmental justice related issues concerning the potential impacts of this regulation and has determined that there are no substantial disproportionate effects. Because the Arsenic Rule applies to all community water systems, the majority of the population, including minority and low-income populations will benefit from the additional health protection."

This case study of the 2000 Arsenic Rule illustrates our concern that an environmental policy might pass a CBA in aggregate, while still making some poor people worse off. Arguably, if such regulatory standards were made at a more local level, then this concern would be alleviated. Alternatively, a closer examination of its effects on the poor (and a prioritization that they be made no worse off), would likewise alleviate this concern.

B. Lead Hazards in Residential Paint, Dust, and Soil

Although there is some controversial evidence of lead affecting cardiovascular health, the primary health concern over lead is that exposure during childhood lowers a person's intelligence (and hence earnings) over their entire lifespan.[23] Hence, EPA regulates lead in sources such as gasoline, drinking water, etc... One of the largest remaining lead exposure sources for children was existing reservoirs of lead in paint, dust, and soil in residential areas. The Toxic Substances Control Act (TSCA) has a section (§403) that was specially created by the Residential Lead-Based Paint Hazard Reduction Act of 1992 to direct EPA to set standards to define the hazards for lead-based paint, including hazards from deteriorated paint and contaminated dust and soil are applied to most housing constructed pre-1978 and child-occupied facilities.[24] As with other pollutants in the indoor environment of homes, EPA does not compel homeowners to undertake remedial action. When these lead standards are exceeded, homeowners are required to disclose it but are otherwise simply encouraged to enter into a contract with a lead abatement professional trained in accordance to TSCA Sections 402/404.[25]

As stated in EPA's RIA, the particular rationale for EPA's policy intervention in lead paint is a market failure based on imperfect information – a homeowner will have a suboptimal demand for mitigating the risk without knowing about their lead problem or the potential severity of its consequences.[26] EPA's RIA estimated the costs to individuals (and hence society) of a lead abatement contractor's remediation, including the cost of their EPA-approved training, as well as the effectiveness and duration of typical remediation. Households were assumed to engage in lead testing upon the birth of their first child (or a real estate transaction). The analysis was conducted for a distribution of housing (built before 1998) and household types (particularly those with a child under age 6). Likewise, benefits were computed from the decrease in blood lead levels (according to EPA's IEUBK model) resulting from such remediation, the resulting improvement in intelligence quotient (IQ), and subsequent improvement in expected lifetime earnings.[27] EPA predicted that the rule would reduce lead exposure for 46 million children in 26.7 million households at the cost of $69B to generate benefits between $49B and $192B.

The impoverishing effect of lead on future generations born into poverty is a prima facie EJ concern. Unlike with the Arsenic Rule, EPA did investigate environmental justice related issues with regard to the potential impacts of this policy on the environmental and health conditions in low-income and minority communities. Interestingly, poor and wealthy households faced roughly the same cost of compliance,

[23] See Robinson (2007) for a thorough discussion of lead toxicity and how EPA has valued reductions in lead exposure.

[24] EPA's standards consider lead to be a hazard when the concentration is not less than 40 $\mu g/ft^2$ for floor dust, 250 $\mu g/ft^2$ for [interior] window sill dust, and 400 ppm in the bare soil in the children's play areas (or a 1200 ppm average for bare soil in the remainder of the yard).

[25] See U.S. Environmental Protection Agency (2000b) for more details.

[26] This information, as well as the remainder of the paragraph is based on EPA's actual RIA for this rule; see U.S. Environmental Protection Agency (2000b) for more details.

[27] The discounted lifetime earnings lost by a 1 point drop in IQ was estimated to be around $8k.

implying that poor households would either forego a larger share of their income to test and remediate lead (in paint, dust, and soil) or would not pay for remediation so that they would still be exposed to higher concentrations. To allay lingering concerns over EJ, EPA started a couple of minor initiatives: the Environmental Justice Initiative (to help reduce lead exposure in high-risk low-income communities with $3.7 million dollars for pilot programs) and the Whole House Initiative (to help evaluate programs which reduce exposure to lead in the home).[28]

This case study of the Lead Paint Rule of 2000 has more subtle implications than our case study of the Arsenic Rule of 2000. Often, environmental regulations are promulgated according to some rationale that serves as a thin veil for disguising paternalism – compelling people to do something that regulators believe that they should be doing. By leaving lead remediation as a voluntary program that works through markets, EPA resisted that paternalistic urge to compel lead paint remediation. However, in regulating this remediation market (e.g. licensing lead paint remediation firms), EPA solved an asymmetric information problem by raising the cost of lead paint remediation. Hence, EPA's minimalist policy intervention may have actually exacerbated an EJ problem that was already quite serious. EPA did conduct a brief EJ analysis within the RIA and reported that it did detect a problem; however that concern was inadequately addressed with a couple of minor initiatives. To adequately address this concern, EPA needs to finance the poor's lead remediation (to at least cover the increase in remediation costs due to EPA's intervention). Indeed, if our society really does care about making the poor better off, then fully subsidizing their lead remediation can be a highly effective policy – on par with improving the education of poor children (both raise future earnings potential). Otherwise, EPA's best intentions have again made the poor worse off.

IV. Some Unintended Consequences

The policymaking landscape is strewn with unintended consequences, supporting a virtual cottage industry of cynical economists serving a watchdog role by identifying unintended consequences. Avoiding the pitfalls of unintended consequences is an important part of good policymaking – lest we acerbate a problem that we sought to solve with policy. Because the unintended consequences associated with environmental policy are documented elsewhere, as are those associated with addressing wealth inequality, we focus on unintended consequences at the intersection of environmental policy and wealth inequality. In this section, we present three unintended consequences that we find to be rather salient (although this list of three should not be taken as exhaustive).

A. Does Tiebout Sorting imply that EJ Concerns are actually Pareto Efficient?

Departing from a dominant assumption of the day (that people are effectively rooted to their initial location), Charles Tiebout (1956) floated a novel theory that has since become a force in the provision of local public goods – that like-minded individuals would band together to form their own communities that provide public goods at a level that is optimal to them. With physical space already partitioned into a patchwork of communities, individuals would sort themselves into a better fitting community (i.e. one with their desired trade-off between public goods and after-tax income) and out of a worse fitting community (which is a self-reinforcing of homogeneity within communities and heterogeneity between

[28] This paragraph is based on EPA's actual RIA for this rule; see U.S. Environmental Protection Agency (2000b) for more details.

communities). Because environmental quality is inherently tied to geographic features (such as mountains and sea) that are fixed in space, the same space that is partitioned into communities, some communities will have higher environmental quality; Tiebout sorting predicts that the wealthy will sort themselves into these communities with higher environmental quality and, in the process, bid up their land rental prices above levels that the poor can afford. Hence, the market mechanism of Tiebout sorting naturally results in a distribution of environmental quality with the wealthy paying for higher environmental quality and the poor getting the lower quality leftovers, which is precisely the sort of outcome decried by EJ advocates. Yet, this Tiebout sorting mechanism is Pareto efficient for roughly the same reasons that Environmental Federalism is Pareto efficient. With a shortage of innovative policy responses, the government could either attempt to transfer income to the poor or improve the environmental quality in their communities.

The first policy option is to alleviate the poverty problem with policies that directly target poor people. Unfortunately, efforts to eradicate poverty over the preceding decades have not been very encouraging. In general, the government lacks a non-distortionary means of transferring wealth – any transfer from the wealthy to the poor tends to shrink the size of the pie of society's wealth. Moreover, such a policy has a host of unintended consequences such as rent seeking that (when allowed to fester into a malaise) may be even more undesirable than the initial inequitable distribution of wealth. Nonetheless, some policies may carry lower deadweight losses than others (e.g. education, the Earned Income Tax Credit, negative income taxes, etc…). Compared to the other alternatives, these may represent our best option to improving the plight of poverty. Yet, even if we transfer more wealth to the poor, we will always have some wealth inequality and some variation in environmental quality, which together imply that the market outcome will be Tiebout sorted with the poor exposed to the lower levels of environmental quality. The correlation between wealth and environmental quality is a natural outcome in a market economy where people are mobile. The only way to break the correlation between wealth and environmental quality is a radical redistribution that equalizes wealth—we believe that most in the top half of the distribution would not consider such a radical redistribution to be a Pareto improvement (except, perhaps, those few who put a sufficiently high premium on equity but detest free-riding enough to not give more to charity).

The other policy option is to make targeted improvements in the environmental quality of poor communities. Unfortunately, this has the unintended consequence of spurring gentrification – the poor community suddenly becomes more desirable, the wealthy move in for that good buy, rental prices collected by absentee landlords are bid up, and the poor are left with no option but to move out because they can no longer afford the rent (see Banzhalf et al. 2012 for a more thorough exploration). This should be seen as a fundamental insight of the Tiebout literature. Because people are mobile, policy should be targeted to people instead of places. Some EJ advocates might then be tempted to argue for an extreme policy response of equalizing environmental quality across all locations but this obviously becomes infeasible – we cannot literally move mountains.

So, the options for addressing EJ concerns in the presence of Tiebout sorting appear to be somewhat limiting in how deeply they cut into Pareto efficiency and perhaps even futile. Applying these insights to our lead paint case study, we expect for the poor to sort themselves into the fraction of the housing stock with lead paint. If some older homes have some other redeeming features, such as attractive architecture or proximity to traditional amenities, then we would expect the wealthy to remediate any lead problems prior to moving in because they clearly should have the resources to afford this modest investment in boosting their children's future earnings. The poor, on the other hand, may face the tricky calculus of trading off the health effects of providing nutrition for their children now versus protecting

their IQ for later. It appears that the best that EPA can do is provide better information to these people so that their privately optimal decisions are better informed. Anything that EPA does to improve lead remediation that results in higher costs of remediation borne by households living in homes with lead paint, including fees for training, will make it less likely that the poor will purchase lead remediation – exacerbating wealth inequality for future generations, which could be considered an EJ failure.

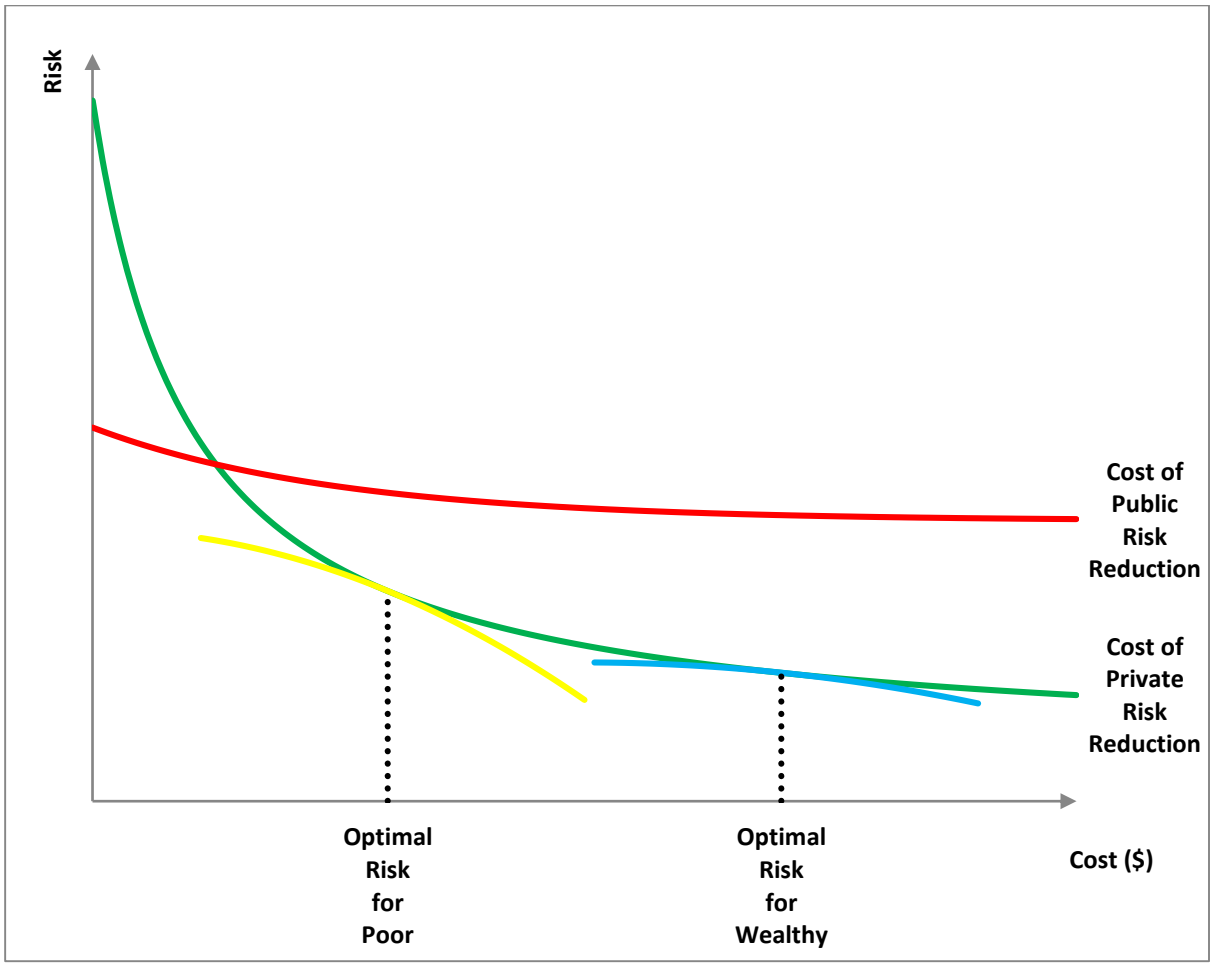
B. Do CBA Justified Interventions Ratchet-down Environmental Risk for the Wealthy?

As discussed in the introduction, CBA works by simulating a market where the benefits are the aggregation of the maximum willingness to pay for each individual who stands to benefit from the proposed policy intervention, whereas the costs are the aggregation of the minimum willingness to accept for each individual who stands to lose from the proposed policy intervention. By mimicking the mechanism by which markets achieve Pareto improvements, CBA is designed to identify whether a proposed policy intervention represents a potential Pareto improvement. The operative word here is "potential" because an actual Pareto improvement would require compensating the losers. Unlike in markets, those who lose (their right to the status quo) under a policy intervention are rarely (if ever) compensated by those who benefit (from acquiring that right). Hence, implementing a policy intervention without compensating its losers implies that it is not a Pareto improvement, by definition. Of course there are good reasons to not attempt such compensation schemes, namely the wasteful distortions introduced by rent-seeking opportunities, but the point remains that if the poor can be made worse off as the result of implementing a policy intervention that is net-beneficial on aggregate.

> One problem with this [Kaldor-Hicks] implementation of CBA is that the agenda of proposed policy interventions is likely to be set by the lobbying of special interest groups. Fueled by those with a superior willingness to pay to bend policy in their direction, economic models of interest group lobbying (e.g. Persson and Tabellini 2002) would predict that the wealthy will use their superior resources to tilt the agenda in their favor.[29] Yet, even when the agenda is tilted toward the policy interventions preferred by the wealthy, the mechanics of CBA do not conform to the ideal of "one person, one vote". Both willingness to pay and willingness to accept are increasing in income, implying that the preferences of the wealthy are given greater weight than the poor.
>
> Thus, successive rounds of utilizing [Kaldor-Hicks] CBA to identify "efficient" environmental policy interventions is likely to result in environmental quality being ratcheted upwards towards the ideal preferred by the wealthy, at the expense of the welfare of the poor. This result resonates with a growing complaint that recently proposed environmental policy interventions (such as a climate change policy) would sacrifice more economic wealth than many are willing to pay, which we would expect to be particularly problematic for the poor and amplified by our growing gap between the wealthy and the

[29] Embedded within our statement, i.e. that the wealthy will tilt the agenda in their direction, is some baseline agenda of potential policy that would be queued for consideration but for the influence of the wealthy. The baseline that we have in mind is the ideal of "one person, one vote", which favor the poor due to their large numbers.

poor. The following figure, adapted from a study by Thomas (2012) of preferences for public versus private risk reductions given heterogeneous wealth, illustrates this yawning gap between the wealthy and poor in the level of risk reduction for which they are willing to pay:[30]



Applying these insights to our arsenic case study, we expect the wealthy to prefer a tightening of the arsenic standard. Without going out on a limb on setting EPA's SDWA agenda, we can at least suggest that the finding that arsenic is nearly costly beneficial is clearly an aggregate result. As described in the case study, despite how close the figures were in aggregate, the costs outstripped the benefits by more

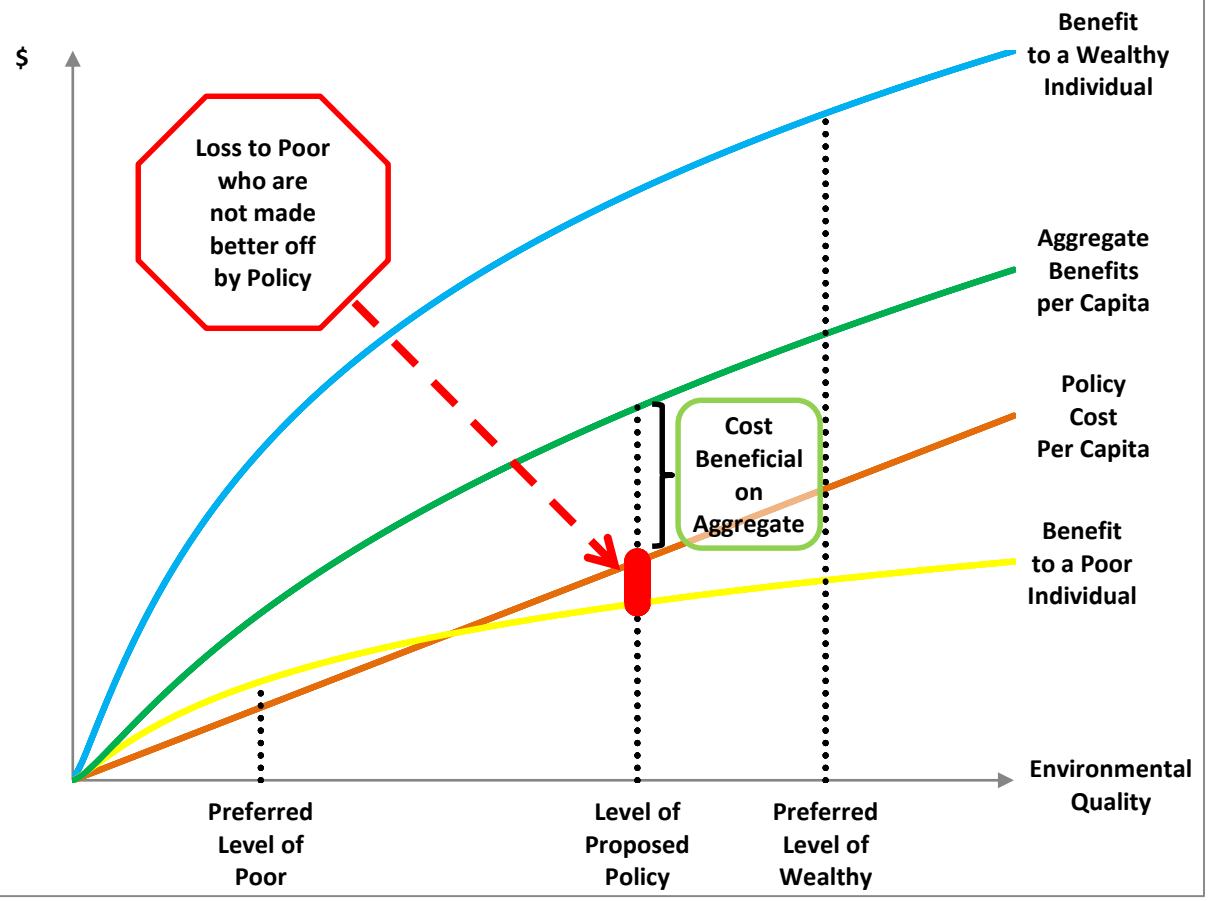
[30] Thomas (2012) makes the interesting point that the set of [cost-effective] opportunities for risk reduction that are available to policymakers diverges from the set of [cost-effective] opportunities for risk reduction that are available to private individuals, which is due to a divergence in scale economies and information. At higher levels of risk, massive scale economies make public risk reductions cheaper; but, at lower levels of risk, public risk reduction is more expensive because policymakers have only an imperfect aggregation of heterogeneous private individuals' information available to them. Note the contrast with the imperfect information argument utilized by EPA to justify the regulations in our case study. Nonetheless, Thomas (2012) argues that the compromise between the public risk reduction preferences of the wealthy and poor (who share the cost) will result in the poor subsidizing the risk reductions of the wealthy and that these risk reductions are likely to be excessively expensive (relative to private costs).

660 than one order of magnitude in small systems (that primarily serve the rural poor). Although it is not clear from the information available, it is possible that the poor would be better off if arsenic had not risen to the top of the policy making agenda.

665 C. Are the Poor sometimes better off without Costly Environmental Improvements?

Coffey (2013) creates a simple model to extend these arguments to their logical conclusion – that some environmental improvements may be sufficiently costly, or sufficiently concentrated on benefiting the wealthy (or both) that the poor would be better off without the environmental improvements.
670 Sometimes the best way to improve the welfare of the poor may be by foregoing additional improvement in environmental quality and leaving that requisite wealth in the hands of the poor (otherwise, they are worse off). The following figure (from Coffey 2013) illustrates that a CBA-passing policy that internalizes environmental quality externalities can unintentionally make the poor worse off:

Figure 2: Costs Exceeding Benefits for Poor when Cost Beneficial in Aggregate



675

Applying these insights to our arsenic case study, we already know that EPA's calculations showed that the proposed policy had costs that dwarfed the benefits for small systems that primarily serve the rural poor. Yet, even these calculations are misleading due to their methodology. EPA uses a single value of a
680 statistical life (VSL) for all people because doing otherwise (i.e. assigning more value to the life of a

wealthy person than a poor person) would seem to be indefensible. However, not everything is as it seems. According to economic theory, the wealthy do place a higher value on their own lives than the value that the poor place on their own lives because the wealthy can afford to pay more. To construct a single value of a statistical life, empirical methods effectively identify the average value across all people – this average is skewed that toward the wealthy due to the mathematical properties of the skewedness of the wealth distribution. By imposing this average value on all individuals, the benefits to the poor get grossly overstated. Thus, the proposed arsenic rule likely was far worse for the rural poor than suggested by EPA's economic analysis. As a result, imposing an ethical constraint of valuing all people equally foists more environmental risk reduction onto the poor than they can afford. Once again, the well-intended efforts at promoting equity in policymaking have the perverse consequence of making the poor worse off.

V. Conclusions

Most of our environmental laws are several decades old, reflecting the first wave of a policy response to immediate and overt risks to human health and environment. They were not crafted with an eye towards either Pareto efficiency or environmental justice. Even to this day, some apologists for the status quo appear to reject the possibility that efficiency and justice may be attainable targets rather than high hurdles. As the culmination of the argument that we have been building, it is possible to achieve targets that are both efficient and just if they are derived from thoughtful, carefully crafted laws and regulations. It is very hard to hit those targets – it requires richer data, more sophisticated methods, policy innovation, and patience plus perseverance. Unfortunately, the current policy regime is biased in the opposite direction under the weight of inflexible laws, shrinking budgets, and bureaucratic inertia.

What, then, must or should be done? Here are a few suggestions.[31]

First and foremost, policymakers and regulators must come to recognize that environmental policy is a highly inefficient tool for improving income inequality – there are already other policy tools that are more effective in addressing income inequality (e.g. education, earned income tax credit, negative income tax, etc…). Trying to shoe-horn an income inequality problem into an environmental solution not only damages the integrity of environmental science and regulation, it is not likely to increase wealth or substantially still its sprawling distribution; even worse, it could backfire and make the poor worse off due to the way cost-benefit analysis favors the preferences of the wealthy. Notwithstanding our policy goal of reducing poverty, it does not follow that every effort to eradicate poverty is necessarily good. Environmental policy with good intentions towards bettering EJ will not necessarily yield good outcomes. Well intentioned environmental policy may even interfere with the expressed preferences of low-income citizens in terms of their major economic choices, such as neighborhood or occupation. Ultimately, the primary problem for the poor is that they lack the resources to purchase the market goods that would make them better off, not that they are mired in low environmental quality. That they tend to consume lower environmental quality is a consequence of their poverty, not a cause.

[31] Our suggestions are not entirely novel, built on decades of the work by others, which implies that these suggestions aren't entirely untested concepts because they have been carefully vetted by experts over the course of many years.

As their wealth grows, we expect them to demand improvements in their environmental policy (fulfilling the environmental variant of Kuznets' hypothesis, see Dinda 2004).

Second, the economic analysis of proposed policy interventions should not include just a CBA but also an incisive analysis of the distribution of those costs versus the willingness to pay of the people who bear those costs. Often, the subsets of the population with a greatest willingness to pay are geographically clustered, likewise for pockets of poverty. With a yawning gap in wealth inequality, a lengthening list of rules can be cost-beneficial in aggregate (i.e. at the national level) but still not be worthwhile in every locality – this is evidenced by the cacophonous chorus of complaints from communities who worry with whether EPA's latest rules are affordable for them. Working from principles of federalism and subsidiarity, lawmakers and regulators should consider devolving statutory and regulatory authorities over local environmental problems to lower levels of government (i.e. local and state governments). The more local the problem, the greater should be the degree of devolution. Clearly, interstate air pollution is not a good candidate for devolution. Hazardous waste clean-ups, which are primarily intrastate in nature, are. To the extent that local authorities lack the same information and expertise, EPA can help provide guidance.

There are other alternatives to our proposal of a distributional analysis to ascertain whether a policy represents a Pareto improvement.[32] One easy option is to leave consideration of the poor to the best professional judgment of the environmental policymaker; Graham (2008) warns that might be much better than an aggregate CBA without any special consideration of the poor: "…without a specific definition of the distributional test, my fear is that regulators will not seriously consider the impact on a group that is so poorly organized in the regulatory process." Another commonly considered alternative is to reweight the benefits and costs of the wealthy and poor, as first considered by Harberger (1978) and recently reconsidered by active researchers such as Banzhaf (2011). The principal problem with operationalizing this approach, as described in Graham (2008), is that there is no agreement on what weights are the correct weights – this is analogous to the lack of agreement as to the form of social welfare function that should be used in a distributional analysis of welfare, which is a problem that receives notable attention from EPA in its draft technical guidance on conducting an EJ analysis (see US Environmental Protection Agency 2013).

When proposed policy interventions are cost-beneficial on aggregate but fail to achieve a Pareto improvement for the poor, there is some theoretical appeal in the idea of compensating the poor for moving forward on that policy; however, in practice it is fraught with rent-seeking pitfalls – sacrificing efficiency for equity can be a slippery slope. If at all possible, it is better to devise a more progressive proposed policy where the greatest chunks of costs are borne by those who have the greatest willingness to pay.

[32] In a thorough and insightful article, Graham (2008) proposes augmenting the usual CBA with a [Kaldor-Hicks] test of whether those in poverty are made better off; the rationale for singling out that segment of society is an appeal to the distributive justice of Rawls (1971). Although this suggestion represents an improvement over no check for the poor, we find it to be somewhat inadequate. Passing that test is necessary for the policy to be a Pareto improvement but not sufficient, which can be readily seen with the mental experiment of considering non-linearity of benefits and costs in a household's wealth position combined with the arbitrariness of drawing a poverty line within a continuum of wealth positions.

Potential legislation on carbon taxation may serve as an exemplar here. Putting a price on carbon is widely believed to have a regressive incidence (e.g. see Metcalf 2009), which is largely because the poor spend a greater percentage of their income on goods with a larger carbon footprint (e.g. HVAC, transportation, etc…). Levying a carbon tax might pass an aggregate CBA due to the very high willingness to pay of a wealthy constituency but still fail to represent a Pareto improvement for the poor who are more concerned with earning enough now to provide food, clothing, and shelter for their children than the climate conditions for their grandchildren. Instead of immediately responding to a complicated and high-stakes problem about which most experts were largely ignorant—afterall, we still have much to learn about the natural processes that govern ecosystems of all scales, including the Earth that supports our very lives— we optioned immediate action in order to acquire additional information so that we could make better policy decisions. Hence, there is a long and rich line of research into market-friendly means for addressing the negative externalities embedded in the emission of greenhouse gases, principally from the combustion of fossil fuels. A carbon tax can be made to be much more progressive by recycling its revenue into the government's budget and retiring other distortionary taxation that is much more regressive such as payroll taxes (for a thorough overview, see Morris and Munnings 2013). We should caution that we are not proposing some perfect policy prescription; there is some concern that this might promote some rent seeking behavior among the poor.[33] Although any government policy will carry some cost in distortions and deadweight loss, we suspect that it would be relatively minor because the poor tend to engage in less rent seeking behavior.[34] Whatever sort of policy intervention we ultimately adopt for climate change, if any, it may not be entirely efficient or just; however, it can be more intelligently crafted so that it dominates the regulatory actions that have grown out of the rash of environmental laws from the 1970s.

Finally, we come to the idea of reasonable regulatory reforms. We acknowledge that ambitious changes are very difficult to realize. Nonetheless, changes that improve our regulatory regime harbor the potential to make us much better off, which is reason enough to pursue reform in its own right. Moreover, the rationale to undertake such reforms is exacerbated by contemporaneous concerns that strain our economy and broader society at large: a lingering hangover from the Great Recession, an aging population, declining real incomes at the low end of the distribution, accelerating entitlement costs, the looming specter of shaky investor confidence), etc…

Under the Barack Obama administration, EPA has accelerated efforts to regulate carbon (e.g. the proposed rule for performance standards on carbon dioxide emissions from new electric power generation plants, see 79 FR 1429), which has been quite controversial in and of itself (e.g. with particularly strong opposition from the coal industry). A landmark in these efforts is the Greenhouse Gas Tailoring Rule that EPA issued to limit the number of entities to be impacted by these new regulations,

[33] As repeatedly pointed out by Yandle (1999) in his astute work, policy is usually sold to the public on moral grounds (e.g. helping the poor) but further pushed by those who stand to gain rent seeking opportunities from the policy. Hence, even if the poor aren't directly seeking rents, others may well seek rents in the name of the poor.

[34] As evidence of the poor engaging in less rent seeking in the environmental policymaking process, see Graham (2008): "A reflection on my OIRA experience underscores why we should be determined to protect and advance the interests of the poor in lifesaving regulation. I do not recall a single rulemaking from 2001 to 2006 in which an outside group lobbied OIRA primarily on the grounds that a regulation was good, or bad, for the poor. Yet we were lobbied to advance the interests of virtually every other group in society, including labor unions, consumer advocates, public health associations, medical providers, farmers, manufacturers, electric utilities, title insurers, bankers, realtors, environmental advocacy groups, and academic institutions."

which EPA justified by invoking "Chevron deference" (by which the court defers the interpretation of a law to the administrative agency, EPA in this case, that is charged with administering it).[35]

"Rather than regulating tens of thousands of sources who otherwise meet the Act's [Clean Air] statutory permitting thresholds of 100 or 250 tons per year, on May 13, 2010, EPA issued a "Tailoring Rule." This rule applied the new permit requirements only to the very largest stationary sources of GHGs-those that meet or exceed a threshold of 75,000 or 100,000 tons per year. This subjected to regulation facilities responsible for nearly 70 percent of national GHG emissions from stationary sources" (Percival et al. 2013).

EPA's rule was upheld upon legal challenge although the "Tailoring Rule" issue was not explicitly decided. But the reasonableness of this rule is readily apparent.[36] Previously, courts frowned upon such "tailoring" of legislative mandates in the pre-Chevron era. Going forward, this approach might make sense, say, under the Clean Water Act (e.g., prioritizing tens of thousands of TMDLs to be developed) or even the Safe Drinking Water Act depending on the risk assessment profile of a given contaminant.

We cite the "Tailoring Rule," not as a definitive case study, but as one that is suggestive of a new realism which should inform environmental statutes and rulemaking in the present era. Another example would be to allow water quality trading to achieve technology-based effluent guidelines, or at least re-design such standards to incorporate trading into them directly as a least-cost compliance option under appropriate circumstances.

One of the toughest areas is the matter of factoring in costs into environmental standard setting in general. Is the Safe Drinking Water Act's "feasibility-limited' standard-setting process adequate? Should the Clean Air Act be amended to allow for the consideration of costs in NAAQS? These issues are daunting and possibly subjects worthy of consideration by a blue-ribbon commission charged with exploring prudent adjustments to our decades-old environmental laws.

The quest to reconcile efficiency and equity requires that we face squarely the challenge of re-tooling the nation's environmental regulatory regime for the sake of the environment and the citizens who depend on it.

[35] For more on Chevron deference, see Salzman and Thompson (2014), e.g. pages 70-71 include: "The approach to statutory interpretation that the Court adopted in Chevron, sometimes referred to as the 'Chevron two-step,' asks two questions. First, has Congress spoken directly to the precise question at issue? If the statutory language is clear or Congress's intent is otherwise clear, then the issue is simple. The court must determine whether the agency action conforms to the unambiguous Congressional mandate. The court exercises a completely independent judgment with no deference to the agency. If, though, as is far more often the case, Congress has not directly addressed the specific question, or is silent, or ambiguous, or has expressly left the gap for the agency to fill, the second step kicks in. In this instance, the court must decide only whether the agency's answer is based on a 'permissible' construction of the statute. The agency's interpretation need not be the best or most reasonable in the eyes of the Court; it simply must be reasonable and not arbitrary, capricious, or an abuse of discretion."

[36] We find the focus on the largest emitters to be reasonable on efficiency grounds (perhaps it is second-best, but it is still reasonable). A more cynical view of that focus would be for political expediency,

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