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Is there Value in the Valuation of Environmental Regulations?

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Abstract

Cost-benefit analysis has become one of the principal components in the review process of environmental regulation. However, the valuation of environmental regulation poses a unique challenge, as the benefits of the rules issued by the Environmental Protection Agency are often nonmonetized, whereas the costs are more readily monetized. To give weight to the very real but nonmonetized benefits of environmental regulation, methodologies have been developed to mark the price of the nonmarketable. Still, many would claim that certain benefits of environmental regulations are not captured in cost-benefit analysis or are undervalued by the practice. Hence, while the practice is promoted by its advocates as advancing rationality in environmental rulemaking, it is criticized by its detractors as hindering all regulations, regardless of whether the rule is beneficial or not. This thesis attempts to clarify the debate around the valuation of environmental goods and services by asking and addressing the following questions: How does the government value the benefits and costs of an environmental regulation? How accurate are these estimates of the benefits and costs? How are these estimates used in the policy making process? Should these estimates be used in the policy making process? And finally, how to change the current institution of cost-benefit analysis to promote better regulatory outcomes? It will be argued that cost-benefit analysis is currently afflicted by a confluence of substantial, institutional, and philosophical biases, but as a practice should be fixed rather than forsaken.

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My Family, who I list last but who will always come first.

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Introduction

The choice to protect environmental services comes with trade-offs. Regulating pollution raises production costs for producers, which in turn raises prices for consumers. Protecting lands results in ceasing the extraction of natural resources, which could result in lost jobs or income. To weigh these tradeoffs responsibly, regulators must deliberate and act upon massive amounts of information. Policy makers must consider economic implications, issues of equality and justice, different private interests, and the difficulty of implementation when drafting potential environmental policies.

Cost-benefit analysis has been offered as a way to inform the policy process to lead to better policy outcomes. Valuation has been promised to facilitate decisions regarding which policies are worth pursuing by demonstrating which regulations will have the largest positive impact on society (Revesz & Livermore, 2008). There is only so much regulation an agency can draft and that the public can bear. Advocates of using cost-benefit analysis hold that the practice pushes regulators to focus on the policies that benefit society to the greatest extent. Just as a company should pursue the projects that will contribute the largest amount to the firm's net present value, a government should pursue the policies that will contribute the most to a society's welfare.

Cost-benefit on its face seems unassailable. It is hard to dispute that a government should pursue policies for which the societal benefits most outweigh the societal cost. As Morrison (1986) writes in the *Harvard Law Review*, "No sensible person can be opposed to planning or to allocating resources meaningfully in order to insure that the most serious problems receive attention first" (p. 1064). Yet, how can something so seemingly obvious attract criticism such as that given by Senator Durbin in a congressional hearing on cost-benefit analysis, during which

he accused cost-benefit analysis of leading to the "endless study of environmental issues over taking actions and making decisions— a classic case of paralysis by analysis" (Revesz & Livermore, 2008, p. 40)? The reason that cost-benefit analysis has sparked such controversy is that some believe valuation as currently conducted adds as much misinformation as information to the policy debate. These critics claim that the methodology for estimating the costs and benefits of environmental regulation employed by the Environmental Protection Agency (EPA) and reviewed by the Office of Information and Regulatory Affairs (OIRA) is not always the methodology that obtains the most accurate estimate of societal costs and benefits. Additionally, opponents charge that once an estimate has been established by an agency such as the EPA, the process instituted to review cost-benefit analysis serves at times as more as an obstruction to any regulation than as an honest appraisal of the methods employed in an agency's cost-benefit analysis. Detractors from the process are quick to raise ethical concerns. The cold calculation necessary in the impersonal translation of lives, vistas, and species into dollars has been attacked by environmentalists as a detraction from the compassion necessary to protect the environment. For these reasons, cost-benefit analysis has attracted criticism from environmental groups since its inception in the Reagan era.

The contention surrounding cost-benefit analysis in the policy making process begs the question of whether there is value in valuation. To assess the utility of cost-benefit analysis in the policy process, it is first necessary to determine whether these estimates can even achieve adequately accurate representations of the value society places on the environment and the cost imposed by potential regulation. According to disparagers of the practice, cases of inaccuracies in the economic analysis limit its effectiveness in the policy process. Erroneous information in

the policy making process will contribute to erroneous policy is the logic held by sceptics of valuation.

First, it might be the case that the economic assumptions that serve as the foundation of the model are flawed. In all the various methods used to estimate costs and benefits of a regulation, an expert must make certain assumptions in order to reach their conclusion. The validity of these assumptions is partially what determines the validity of the model. However, even if the assumptions underlying a model are sound, the model still could have been improperly implemented. When applying a valuation method, a researcher must make choices in specification that can drastically impact the final estimate. The potential to mis-specify variables or just omit important control variables is present in many types of valuation methodologies (Harrison & Rubinfeld, 1978). Another concern that needs to be considered when employing certain valuation techniques is sampling bias. Methods that rely upon survey results to reach a conclusion of cost or benefits are problematic if the sampled population does not represent the stakeholder community. The question of the accuracy of the various valuation methods is theoretical and statistical in nature, capable of being answered through sound economics, surveying, and regressions. Although there has been considerable research into analyzing at the theoretical level the accuracy of methods to value environmental goods, it is still an important area of inquiry and necessary to consider when assessing the utility of the valuation of environmental regulations. These models have never been and will never be perfect, but they are often treated as of indisputable utility in the policy making process. The inability to address the inherent margin of error of these models leads to undue weighting of cost-benefit analysis within the policy making process.

In addition to the technical problems present in valuation of environmental services, there also exists the question of the political effectiveness of such analysis. Critics of cost-benefit analysis claim that cost-benefit analysis serves to only distort the policy making process, distracting from the needs of citizens by instituting a "technocracy" of experts (Ascher & Steelman, 2006). Cost-benefit analysis is a means by which to measure the preferences of all elements of a population. In an extreme scenario in which cost-benefit analysis is given total power in the rulemaking process, the attitudes and preferences of citizens would not be decided by the citizens themselves, but by a group of experts who claimed be able to quantify the values of society. This shift away from direct representation as well as representative democracy becomes more problematic in proportion to degree of inaccuracy of the models. It should be clarified whether cost-benefit analysis is meant to convey democratic expression or whether it is meant to replace democratic expression.

Another political consideration is that cost-benefit analysis might just fail to pass its own cost-benefit analysis. Alan Morrison, founder of one of the main interest groups opposed to cost-benefit analysis, the Public Citizen Litigation Group, argued in 1986;

> The vast amount of additional resources spent in justifying proposed regulations to OMB, as well as in obtaining the necessary OMB clearance to undertake the studies needed to decide whether to begin work on a problem in earnest, are all a burden on the federal treasury, yet there is no indication that these costs have been balanced against the benefits to be derived from this complex labyrinth of OMB overlay" (p. 1066).

Critics such as Morrison are quick to point out that millions of taxpayer dollars are spent constructing economic impact assessments. Why would this money be spent on assessments if it were the case that these assessments have a negligible or negative impact on the regulatory process? Cost-benefit analysis is more time and labor consuming than other types of analysis, such as health based analysis or technology based

analysis, because it requires the health and technology components as well as the monetization of those components (Driesen, 2006, p. 386). It might be the case that the extra burden necessitated by cost-benefit analysis does not justify the information added by the practice.

Yet another issue opponents of cost-benefit analysis have with regard to the impact of valuation in the formation of policy is that the cost-benefit rules established by the executive branch only necessitate the consideration of cost-benefit analysis in the case of a new regulation, and there is no requirement for such analysis in the case of deregulation (Livermore, 2009, p. 117). Said differently, valuation of economic services is not undertaken by the government when a regulation is repealed. Such analysis is conducted only after a regulation has already been confirmed by an agency in order to determine whether or not this piece of policy is economically sound. Deregulation could have costs larger than the benefits of inaction. However, an agency is not required to defend deregulation through a cost-benefit analysis. This dichotomy contributes to fewer regulations protecting the environment, as created regulations can be disapproved by unfavorable cost-benefits analysis, while deregulation is unhindered by the necessity of cost-benefit analysis.

Even if the methods used in cost-benefit analysis were able to perfectly quantify the value of an environmental amenity, and the analysis was useful in advancing the installment of beneficial policy, what purpose should this valuation have in the policy making process? An argument could be made that a right to certain environmental amenities exists and that no cost-benefit analysis could justify the infringement of such a right (Whittington & Grubb, 1984). It has been argued that nature's right to exist transcends law (Weiss, 1984). It may not be demanded by law to protect a certain unique and threatened soil type, but it might be demanded

by morality to protect such a resource. Taking for granted an implicit right to certain environmental standards, is any cost-benefit analysis that would infringe upon this right morally defensible? Human centered values are by definition an anthropocentric concept. A market system creates pareto efficiency by ensuring that the optimal combination of goods is provided to the consumer at the lowest cost possible to the producer, but producers and consumers will always be humans. An ethical argument could be made that value exists outside of the human experience. As an ethical question, no universally accepted position can be reached. Still, it is necessary to consider the question of whether benefits outweighing costs should always justify proceeding with or putting pause to a proposed regulation.

A serious ethical concern introduced by valuation of economic services is whether these methods lead to equitable policies of regulation and environmental protection for all members of a community. Cost-benefit analysis as currently conducted seeks policy that maximizes societal welfare, but can neglect to account for the distribution of the benefits and costs to society. It is sometimes the case that a potential regulation puts an undue burden on marginalized groups and that the policy, even if efficient, is not equitable. Critics of cost-benefit analysis argue that this objective of cost-benefit analysis leads to policy that protects the interest of firms at the plight of minority groups (Whittington & Grubb, 1984). Additionally, the bias of those responsible for preparing valuations could lead them to undermine or ignore benefits or damages presented by a policy. For instance, a regulator might be unaware that a certain environmental amenity holds value to a Native American population, leading the regulator to omit such values from their analysis and underestimate the benefits of the environmental amenity.

Despite these possible objections to the importance of valuation in the rulemaking process, strong arguments have been made supporting that valuation is a valuable consideration

in creating environmental protection measures. First, valuation incentivizes government agencies to consider and minimize costs when drafting policy. Without the necessity of cost-benefit analysis, an agency has far less incentive to minimize abatement cost for producers. To achieve environmental protection, there will always be multiple instruments available. Supporters of cost-benefit analysis would argue that valuation renders policy makers more aware of the costs of an instrument (Revesz & Livermore, 2008). With the requirement of a cost-benefit analysis, the agency has more incentive to seek the program with the smallest costs in order to achieve favorable valuation and hence approval from OIRA. For example, regulators might choose to target firms with low abatement costs in order to minimize costs rather than regulate all firms uniformly. Regulations always come with costs, and necessitating that new policy be accompanied and supported by cost-benefit analysis brings these costs to mind for policy makers.

Second, cost-benefit analysis, if implemented properly, aims to achieve the maximization of social welfare. The socially efficient allocation of pollution is the quantity of pollution at the quantity where the marginal benefit of pollution is equal to the marginal damages of pollution. Proponents of cost-benefit analysis would say that, unlike direct referendum, theoretically cost-benefit analysis will show whether the abatement of pollution brings a society closer to the maximization of welfare in an economic sense when there are many parties with a weak preference and few with large preferences. In a direct referendum, unless the marginal willingness to pay for pollution is equivalent at all pollution levels for all members of society, it is possible that a vote will reflect support for a policy that is further from economic efficiency. This results because the various measures of marginal willingness to pay and accept for each member of society are not considered at the ballot box. Said differently, in a referendum, for any

given issue, each member of a society has equal say, regardless of whether they have equal stake. Hence, for a direct referendum, the decision that benefits most of the populace would be made, regardless of whether it maximizes overall value. Proponents of cost-benefit analysis would say that the practice aims to rectify this limitation by incorporating preference magnitude into the process.

In addition to accounting for differences in preference magnitude, proponents of cost-benefit analysis hold that cost-benefit analysis should account for all citizens' welfare, regardless of whether they participate in the policy process. These supporters would argue that in a regulatory process motivated by voting and lobbying by special interest groups, only parties that dedicate the time to vote or the money to donate would be considered, and in valuation the interests of every stakeholder could be estimated through various methods. For instance, the survey results gathered can be extended to the entire population as an estimate for the societal cost and benefits. This is why economists such as John B. Loomis (2000) argue that "Without valuation studies, only those with sufficiently concentrated costs or benefits who attend hearings or committee meetings or make large campaign contributions will be heard. Valuation studies have the potential to provide an effective way to diminish the often bemoaned role of 'special interests' in the current policy process" (p. 343). Supporters of cost-benefit analysis view the method as a means to break free from the importance of lobbying in the legislative process. They maintain that valuation finds the optimal policy for all of society and not just the special interest groups capable of exercising power in Washington.

Another argument in favor of cost-benefit analysis is that the practice allows for improved political control by eliminating information asymmetries between principals and agents (Livermore, 2014). In the principal-agent model of regulation, the Executive and

legislature are principals that use agencies to accomplish political directives on their behalf. However, there is some distance between what the principals desire and what the agencies implement, leading to the need to monitor the agencies to ensure that they are acting in alignment with principal's vision. Principals will monitor until the marginal cost of monitoring the agencies is equal to the marginal benefits of control. In the principal-agent framework, the regulatory review body OIRA acts as a proxy for the President. Some, such as Posner, hold that cost-benefit analysis improves the agent principal interaction by eliminating the information gap between agencies and the Executive by necessitating that agencies report back to the principals (Eric A. Posner, 2001).

Those in favor of increased regulatory activity by the government are usually critical of cost-benefit analysis applied to regulation, but some have made arguments that cost-benefit analysis can allow for agency autonomy, albeit in an indirect way. Livermore holds that cost-benefit analysis serves as a "safe harbor" to "unrestricted review". He writes, "The existence of a substantive standard limits the types of issues that can legitimately be raised by reviewers and reduces the potential for arbitrary interference in agency decision making" (Livermore, 2014, p. 621). Cost-benefit analysis serves to constrain review by limiting the objections that can be raised by the reviewing agency. That is, cost-benefit analysis offers a standardization of review practices, in turn creating diminished review pressure. As long as agencies perform cost-benefit analysis within the framework specified by OIRA, they can usually avoid OIRA's heavy handed scrutiny. This standardization also eases the conflicts that naturally arises between OIRA and the agencies by limiting the scope of the objections OIRA can raise, as it is well established what are the standards for cost-benefit analysis. A secondary consequence is that agencies are motivated to increase their ability to conduct cost-benefit because competent analysis will lead to

diminished review. The agencies will build out their ability to conduct cost-benefit analysis by hiring economists who are well practiced in the valuation methodologies. These actors at the agency and OIRA will speak the same language and be better equipped to resolve conflicts that are inevitable to arise in the regulatory review process.

The issues surrounding valuation of environmental services can be divided into three categories. *Substantive* considerations result from inadequacies found in the assumptions of a model or the construction of the model. *Institutional* considerations relate to the use of cost-benefit analysis in the judicial or regulatory process. *Philosophical* considerations stem as the consequence of valuing environmental services and relate to questions of right and wrong in regard to the duty of humans to the planet. This thesis will primarily address the substantive and institutional issues in valuation of environmental services but will also note the philosophical issues surrounding cost-benefit analysis. Although there is much literature analyzing either empirical validity of cost-benefit analysis of environmental goods, or analyzing the political implications of cost-benefit analysis in the policy process, there is little work connecting the empirical limitations of valuation to the ethical and political issues that surround the practice. This thesis will attempt to bridge this gap by highlighting the interrelation of the different issues surrounding cost-benefit analysis.

A History of Cost-Benefit Analysis in Regulatory Review

From the 1940s through the 1970s, there was a substantial increase in regulation by the federal government. The number of employees working at Federal regulatory agencies from 1960 to 1980 increased from 57,109 to 146,408, while Federal regulatory spending increased from $4 billion to $19.7 billion (2012 dollars) (Febrizio & Warren, 2020). Conservatives viewed this ballooning of federal spending with alarm and were searching for a tool to check the growth

of regulatory programs. In response, conservative academics began to build a body of research suggesting that the rise of regulations was the result of career-building bureaucrats and that regulations were costing the American public tens of billions. In his book published in 1971, *Bureaucracy and Representative Government,* economist William A. Niskanen framed regulators as career-minded opportunists. Niskanen (1971) claimed that a bureaucrat essentially serves to maximize the amount of regulation he or she can pass subject to a budget constraint. He writes, "A bureau offers a promised set of activities and the expected output(s) of these activities for a budget. The primary difference between the exchange relation of a bureau and that of a market organization is that a bureau offers a total output in exchange for a budget, whereas a market organization offers units of output at a price" (p. 25). Other academics, such as Weidenbaum and Defina (1978), attacked from a different angle. In one of the first studies of its kind, they found that federal regulations were costing the U.S. economy as much as $66 billion per year. They are often credited as the first scholars to call for cost-benefit analysis of regulation, promoting "government regulation should be carried to the point where the incremental costs equal the incremental benefits" (p. 23). Economists of this school of thought promoted deregulation as a way to spur economic growth.

The inflation of the late 1970s and the rise of Ronald Reagan created the conditions for the institutionalization of cost-benefit analysis. Reagan appealed to the working class's deep fear of inflation and economic insecurity, framing the increases in regulation as the culprit for the stagflation plaguing the country. In a debate with Jimmy Carter, Reagan launched into a critique of regulations "that Government can do without; that have added $130 billion to the cost of production in this country; and that are contributing their part to inflation" (Commission on Presidential Debates, 1980). The notion that government overreach was hindering the economic

advancement of the American people found resonance with the public, and Reagan ousted Carter in a landslide victory, gaining 489 electoral votes to Carter's 49. In addition to the Presidency, the Republicans gained control of both houses of the legislature, flipping 12 democratic seats in the Senate. With control of the executive and the legislature, conservatives were now ready to incorporate the theories of cost-benefit analysis into the regulatory framework.

With the issuance of Executive Order 12291 in February of 1981, Reagan established the basis for cost-benefit analysis that remains partially intact six presidencies later. The head of OIRA during Obama's first presidency, Cass Sunstein (2018), said of the Executive Order, "To date, the cost-benefit revolution has had three defining moments…. The first moment, and by far the most important, came from Ronald Reagan in 1981, when he signed Executive Order 12291" (p. 6). Executive Order 12291 mandated that

> (a) Administrative decisions shall be based on adequate information concerning the need for and consequences of proposed government action;
> (b) Regulatory action shall not be undertaken unless the potential benefits to society from the regulation outweigh the potential costs to society;
> (c) Regulatory objectives shall be chosen to maximize the net benefits to society;
> (d) Among alternative approaches to any given regulatory objective, the alternative involving the least net cost to society shall be chosen; and
> (e) Agencies shall set regulatory priorities with the aim of maximizing the aggregate net benefits to society, taking into account the condition of the particular industries affected by regulations, the condition of the national economy, and other regulatory actions contemplated for the future. (Exec. Order No. 12291, 1981).

The order required that all U.S. federal agencies prepare cost-benefit analysis for "major" regulations, and that the agency must demonstrate that the approach chosen to reach a regulatory objective to be the least cost approach. The order was built upon precedents set as early as Kennedy but represented a shift in importance of valuation in policy making. Johnson's Planning Program Budgeting System, Nixon's Quality of Life Studies and Management by Objective, and Carter's Executive Order 12044 all informally advocated the consideration of cost and societal

welfare in rule making. Yet, it was not until Reagan that cost-benefit analysis was formally required (Whittington & Grubb, 1984). A distinction between Executive Order 12291 and its predecessors was that it held cost-benefit as the single greatest consideration when drafting policy and rejected alternative considerations such as distribution of costs and benefits. The order pushed agencies to be singularly focused on maximizing the difference between benefits and costs.

The rule functioned as follows. For each major rule, defined as a rule whose "annual impact on the economy" exceeds $100 million, an agency must prepare a regulatory impact analysis (RIA). Each RIA must include a description of benefits and costs, identification of who will receive the benefits and bear the costs, and a list of potential regulations that could achieve the objective at lower cost and an explanation of why these alternatives are not legally permissible. The Office of Management and Budget (OMB) was made the centralized reviewer of the RIA for each rule. Within OMB, OIRA serves as the body to dissect and comment upon the RIAs submitted by the various agencies. OIRA is divided by "branches" that focus on different policy areas. Each branch is headed by a desk officer responsible for overseeing the RIAs from a few agencies. Agencies are restricted from publishing their rules in the federal registrar until the OMB had completed its review. When OIRA gives a regulation its approval, OMB's considerations as well as the agency's response to those comments are published in the Federal Registrar alongside the rule itself. For major rules, Executive Order 12291 requires the RIA to be made public. The order represented an increase in the ability of the Executive to control regulatory review and increased the importance of budgetary considerations in the regulatory process.

Executive Order 12291 had immediate and controversial impacts. An often-cited statistic among supporters of Order is that the length of the Federal Registrar went from 82,012 pages the year prior to the order to 58,494 pages the year following the order (Magnuson & Thomas, 1983). However, the order drew fire from pro-regulatory interests as soon as it was issued. Deputy Administrator of OIRA under Reagan, James Tozzi noted, "I was heavily criticized by the environmental groups and we were frequently called up to [congressional] committee hearings. It was bloody. I loved it" (Davidson, 2002). Detractors protested that the review process happened behind closed doors, and served to only hinder regulation (Morrison, 1986). In response, when Clinton took power, these detractors were hopeful that the liberal President would completely reverse the actions of the Reagan administration. However, Clinton chose to alter, rather than demolish, Reagan's executive review framework. With Executive Order 12866, Clinton created disclosure requirements for OIRA, including necessary publication of all communications between OIRA and individuals "not employed by the executive branch of the Federal Government regarding the substance of a regulatory action", a log of the status of all regulatory actions, and all documents "exchanged between OIRA and the agency during the review by OIRA" (Exec. Order No. 12866, 1993). Additionally, Clinton included articles that explicitly called for the consideration of the equity and distribution of impacts in the drafting of RIAs. Still, the framework established by Reagan remained intact, albeit modified to appease pro-regulation detractors.

After his election in 2000, George Bush did not revoke Clinton's Executive Order. He did, however, shape the regulatory review process by appointing John Graham as head of OIRA. Graham was a strong believer that cost-benefit analysis should be used as to check government overreach and his nomination was met with outcry from pro-regulatory groups (Livermore,

2009). In another move to tighten the grip of the Executive on the review process, Bush issued Executive Order 13422, which modified Executive Order 12866 by requiring an agency to identify "in writing the specific market failure (such as externalities, market power, lack of information) or other specific problem that it intends to address" (Exec. Order No. 13422, 2007). The Executive Order additionally extended the reach of regulatory review to the guidance documents drafted by the agencies. Overall, Bush kept the modifications of the Clinton administration while strengthening the control of the Executive over the review process.

When Obama took office, with Executive Order 13563 he moved to revoke the changes made by Bush. According to the Head of OIRA under the Obama administration, Cass Sunstein (2018), Obama wanted to put full support behind cost-benefit analysis because "That's what the American people want, and that's what they deserve" (p. 19). Obama's Order placed further emphasis on non-quantitative considerations such as "equity, human dignity, fairness, and distributive impacts" (Exec. Order No. 13563, 2011). Additionally, the Order required retrospective analysis of existing rules to "to modify, streamline, expand, or repeal" any rules that are found to be inadequate (Exec. Order No. 13563, 2011). This Executive Order represented over 30 years of adherence to the cost-benefit regulatory review scaffolding initiated under Reagan.

Donald Trump revised the regulatory review process more than any President since Ronald Reagan. By issuing Executive Order 13771, Trump mandated that for each new rule implemented by an agency, two rules needed to be cut out (Exec. Order No. 13771, 2017). On top of this already momentous shift, the Order requires that the cost of any new rule be offset and that all rules operate under a regulatory cost cap. The emphasis on a cost-only approach marked a shift away from the welfare maximization aims of earlier executive orders. Whereas cost-

benefit analysis sought to achieve maximum societal welfare, Trump's vision was for the analysis to achieve minimization of costs. This Order has generated some of the stiffest resistance from pro-regulation groups since the initiation of the cost-benefit era. The Order was labeled as "a pretty silly idea" by former director of OIRA Cass Sunstein, William Gale from the Brookings Institution said of the measure, "This seems like a totally nonsensical constraint to me" (Geldis 2017), Hana V. Vizcarra of the Harvard Law School called the Order a "very aggressive attempt to rewrite our laws and reinterpret the meaning of environmental protections" (Popovich, Albeck-Ripka, and Pierre-Louis 2021), and former Director of the Bureau of Consumer Protection went so far as calling the Executive Order "unconstitutional, illegal and stupid" (Gerstein 2017). However, the Order was effective in reducing the number of regulations finalized. The first year after the Executive Order was given, the OMB finalized 67 deregulatory actions and only three regulatory actions (Economic Studies at Brookings 2019). Overall, Trump's actions were viewed favorably by regulated industries.

When Biden ousted Trump from office, one of his first actions was to nullify the Trump executive orders. The same day he was sworn into office, Biden signed a presidential memorandum modernizing regulatory review. Regarding Clinton's amended Executive Order that had stood as the basis of cost-benefit analysis during the Clinton, Bush, and Obama years, the Biden administration did acknowledge that it aimed to reaffirm "the basic principles set forth in that order", but also called for "recommendations for improving and modernizing regulatory review" (Biden 2021). Of foremost importance in Biden's agenda for regulatory review was the inclusion of non-monetary considerations, such as "public health and safety, economic growth, social welfare, racial justice, environmental stewardship, human dignity, equity, and the interests of future generations" (Biden 2021). Another one of the goals listed in the memorandum was to

revise the nearly 20-year-old guidance document on how to implement cost-benefit analysis, the OMB Circular A-4 (Revesz 2021). A third pivotal shift proposed by Biden is employing the OIRA to actively partner with agencies to identify potential programs "that are likely to yield significant benefits" (Biden, 2021). Biden's agenda for regulatory review represents as start contrast to the policy promoted by the Trump administration. While Trump sought for OIRA to focus on the cost of regulation, Biden thus far has signaled that OIRA will serve to defend and identify the benefits of regulation.

The pattern that emerges from the 40 years of the cost-benefit era is that conservative Presidents tend to use regulatory review as a tool to slow down regulation, while liberals either view the practice with alarm or see cost-benefit analysis as a means to justify or identify needed regulations. The attitudes of liberals towards cost-benefit analysis has become more supportive as methods have been developed for valuing the benefits of regulations as well as the costs. In general, conservatives tend to hold whether the analysis displays larger benefits than costs as the most important consideration, while liberals are more willing to make exceptions when favorable cost-benefit analysis does not align with goals for equity or environmental stewardship. Although amended, the executive regulatory review of costs and benefits created by Reagan still serves an important role in the policy process.

The Theoretical Basis of Valuation Methodologies

Overview

Two approaches are permissible for valuing benefits and costs of a regulation; revealed preference methods and stated preference methods. For regulations affecting products or services traded in markets, the transactions within the market can easily be used to determine willingness to pay. Willingness to pay is then interpreted as what an individual would be willing to forgo to

receive the good. However, many environmental goods are not marketed. That is because many environmental amenities fall into the category of public goods as they are non-rival and non-excludable (Samuelson, 1954). Some examples of environmental goods fall into this category include clean outdoor air or biodiversity. Just because one person enjoys clean outdoor air or biodiversity does not restrict another person from enjoying clean outside air, and there is no (legal) way to stop the consumption of air. As these goods are public, there exists no market by which to sell and buy units of this good. Therefore, indirect techniques are necessary to value environmental goods and services (Carson & Hanemann, 2005). In revealed preference techniques for valuing environmental goods and services, market transactions that are affected by the quality of the environment are used as a proxy to determine the willingness to pay for an environmental amenity (Revesz & Livermore, 2008). In the stated preference methodology, survey techniques are employed to determine hypothetically how much respondents would be willing to pay for an environmental good, should a market exist. For these two approaches, contingent valuation is the most commonly used stated preference technique, while hedonic pricing is the most commonly applied revealed preference method (Carson & Hanemann, 2005). What follow is a discussion at length of the theoretical basis and empirical accuracy of these two methods, which partially determines how useful their application is in the policy drafting and review process.

Contingent Valuation

In contingent valuation, a value of a good or service is determined through survey techniques. The method is able to arrive at an individual's willingness to pay or accept payment for a good or service through questioning individuals by phone, in person, or mail in surveys. The structure of a typical contingent valuation survey is as follows: (1) some introduction to

acquaint the respondent with the issue and determine respondents' prior knowledge, (2) questions designed to obtain the respondents willingness to pay or accept, (3) debriefing and demographic questions (Carson & Hanemann, 2005). The results of a contingent valuation survey can be used to determine the distribution of willingness to pay, as well as how willingness to pay is correlated to income, demographics, or knowledge of the good itself.

The method was pioneered in the 1940s by economists looking for a way to estimate the social welfare lost by environmental harm as predicted by Pigou (Bowen 1943). The first formal CV study was conducted by Davis (1963) on the economic value of outdoor recreation in Maine's forest. However, early survey techniques lacked the nuance of modern methods, leading to unreliable results (Ridker 1967). With improvement in survey techniques through application of lessons learned from the field of social psychology, contingent valuation was soon successfully used to value the right to hunt game, hike on an uncongested trail, and be free from soot and dust pollution (Carson & Hanemann, 2005).

Indifference functions are useful in understanding the economic basis of contingent valuation. Say the aim is to value some environmental good, which will be denoted Q. The various levels of Q are denoted by q. Assume that an individual's utility is a function of the level of Q and X, the vector which represents the consumer bundle of all other goods, whose level will be denoted as x. The individual's utility can be represented by the equation, $u(x, q)$. Further assuming that the individuals face the constraint of a limited income, which is given the variable y, the individual's indirect utility function is given by $v(x, q, y)$. The value of a marginal change in q can be found by finding the difference in the indirect utility function at various levels of q, $q_1$and q_2, such that $q_1 < q_2$. The value that the individual places on consuming different quantities of q is equal to

$$v(x, q_2, y) - v(x, q_1, y)$$

If $v(x, q_2, y) - v(x, q_1, y) > 0$, then it can be assumed that the change is an improvement. Let C be the compensation variation necessary so that

$$v(x, q_2, y) = v(x, q_1, y + C)$$

C is the maximum amount an individual would be willing to pay in order to forgo the preferred quantity of the good. We can express the compensation variation as

$$C = C(q_1, q_2, p, y)$$

The aim of the contingent valuation study is to determine this compensation variation function. It is helpful at this point to introduce the expenditure function, which is derived through minimizing expenditure subject to a utility constraint. The compensation variation can alternatively be expressed as the difference between the expenditure function m at different quantities. That is,

$$C = m(p, q_1, u) - m(p, q_2, u)$$

So, the compensation variation is also equal to the difference in expenditure necessary to achieve the same utility at different quantities of a good, holding the price constant.

To arrive at a willingness to pay through survey responses, a researcher must execute the following procedure. This process involves two parts, the inclusion of a statistical element into the model leading to a distribution of willingness to pay, and a link between the willingness to pay distribution and the distribution of survey responses. The link differs slightly based on whether the survey design provides open ended (how much would you pay for an increase in the quantity of the good from q_1 to q_2) or closed ended (would you pay x amount for an increase in the quantity of the good from q_1 to q_2). Under the open ended format the willingness to pay cumulative density function G_c(x) is given by $P(response = x) = P(C = x) = G_c$(x) whereas

under the closed ended format the willingness to pay cumulative density function is given by $P(response = yes) = P(C \geq x) = 1 - G_c(\mathrm{x})$. Although a closed ended format reveals only a minimum for the total willingness to pay, it can still be used to acquire the willingness to pay distribution.

To arrive at a willingness to pay distribution a researcher can either assume that a distribution for the willingness to pay and employ linear regression techniques to determine the expected value of the compensation variation or a researcher can introduce a random term directly into the utility function. The difference between these approaches is that by assuming a distribution, the researcher assumes the compensation variation is a random variable, whereas introducing a random term into the utility function requires the assumption that the individual is perfectly knowledgeable about their willingness to pay and it is the investigator who has incomplete knowledge of the individuals utility function. Using a logit, log-logistic, or probit response model, a graph of the response probability distribution can be constructed. This graph serves as the demand graph for a change in quantity. After extrapolating maximum and minimum values of the willingness to pay, interpolating between the various survey responses, and integrating under the probability density function, a researcher can acquire the mean willingness to pay. In turn this mean willingness to pay is used to estimate welfare loss or gains based on changes in environmental quality.

Contingent valuation has numerous benefits over other methods. As Carson and Hanemann (2005) write, “It is hard to overestimate the central importance of contingent valuation to modern environmental economics” (p. 826). One of the largest advantages of contingent valuation is that it allows for the estimation of non-use values, the altruistic, bequeath, and existence values discussed previously. Krutilla (1967) demonstrated that neglecting to

include nonuse values would result in an inefficient allocation of environmental amenities. These values were previously considered immeasurable until Randall, Ives and Eastman proved that contingent valuation using a bidding game could be used to arrive at an estimate of non-use values. This spawned a massive rise in the importance of contingent valuation in the valuation of environmental services. Another advantage is that the survey can assess both the public's attitudes towards the outcome of a policy but also the instrument of the policy itself. The public might desire an outcome from a policy but might be opposed to the manner by which this outcome is achieved. For instance, the public could view cleaner air achieved through a tax on gasoline differently than cleaner air achieved through stricter car manufacturing regulations. A third advantage is that contingent valuation allows for the analysis of consumption bundles that are not currently in existence. There are instances that the consumption bundle being valued is so novel that there is currently no proxy available to use a revealed preference approach. All of these benefits make contingent valuation a useful tool when valuing environmental goods.

Hedonic Pricing Model

The theory behind the hedonic pricing model was popularized by Rosen in his groundbreaking work, *Hedonic Prices and Implicit markets* (1974). However, the origins of hedonic pricing can be traced back to a 1939 study by Court, which used automobile prices as a proxy for willingness to pay for improvements (Palmquist, 2005). Hedonic pricing can be used for any implicit market, but hedonic pricing refers specifically to "models that measure differences or changes in the value of real estate" in the context of environment regulation cost-benefit analysis (OMB 2003). As Rosen (1974) states, the beauty of the method is that the "Estimation of marginal prices plays the same role here as do direct observations on prices in the standard theory and converts the second-stage estimation into a garden variety identification

problem" (p. 50). Since its inception, Rosen's two stage estimation approach has gained popularity for its ability to estimate the underlying structure of the demand curve (Freeman et al., 2014). Today, hedonic pricing is used to value goods as different as air quality (Bayer et al., 2006) and golf courses (Limehouse et al., 2010).

The method uses two steps to assess the implied cost of pollution through the proxy of the real estate market. Assume that any housing unit *H* can be completely defined by an array of its characteristics, which include quality, neighborhood, and environmental variables. Therefore, it follows that the price of the defined house, P_{hi}, can be fully described as a function of its quality, neighborhood, and environmental characteristics, delineated with the variable names *S, N,* and *Q* respectively.

$$P_{hi} = P_h(S_{i1}, \cdots, S_{ij}, N_{i1}, \cdots, N_{ij}, Q_{i1}, \cdots, Q_{ij})$$

The function P_h is the implicit price function for a unit of housing. By differentiating the implicit price function with respect to the various characteristics, we find the individual price function of that given characteristic. That is, for some environmental parameter of interest Q_i, differentiating the overall price function results in

$$\frac{\partial P_h}{\partial Q_i} = P_{Q_i}(Q_i)$$

In words, the relationship between the price of a house and the environmental quality of that house, holding all other variables constant.

So, taken in the context of an individual buyer in a market, each household will move along each attribute's price function until they reach the point where the marginal cost of gaining the attribute is equal to the household's marginal willingness to pay. If equilibrium is attained, then the implicit prices associated with a given housing bundle will equal the marginal willingness to pay for each attribute (Freeman 1979). However, this price function should not be

equated with the demand function. The price function is merely the locus of all the points where the individual demand functions of various participants in the market equaled the marginal cost or price function for that attribute. Thus, a secondary step is necessary to derive the demand function from the price function.

An individual's willingness to pay for an additional unit of a characteristic of a house is dependent upon that individual's current consumption of the characteristic, income, race, gender, political affiliation, and so on. To gauge the aggregate willingness to pay, it is necessary to relate the implicit cost function to the supply side of the market. On the supply side, three possibilities for the relationship between price and quantity supplied of houses with given attribute bundles exist: that the supply curve is perfectly elastic, perfectly inelastic or some elasticity in between. If supply is assumed to be perfectly elastic, then the implicit prices paid by each household are totally independent of the household's current level of consumption. A regression of the implicit prices against the various socioeconomic variables that determine preference should result in a demand function. Under the case where supply is perfectly inelastic (that the number of houses with bundles of given attributes is constant), then a similar regression is conducted but the implicit price paid by each household cannot be considered exogenous to the actual level of consumption. In the scenario when supply is neither perfectly elastic, or perfectly inelastic, a simultaneous equation approach is necessary.

Which one of these assumptions is more accurate in reality is determined by the speed of adjustment of the supply curve. If it were true that housing markets could only adjust extremely slowly to changes in marginal price, such as those caused by increased demand and hence increased price for an attribute like clean air, then the assumption that best fits reality is that the supply for the attribute is perfectly inelastic. However, to use a hedonic pricing model in the first

place requires that one assume the market is in equilibrium, requiring that supply be allowed to shift to its long run state. Two exceptions exist when it is either impossible or unnecessary to derive demand from the model. One occurs when the implicit cost function is linear, as then the marginal implicit price is constant, and demand cannot be inferred. A second exception is when the willingness to pay functions of each household are identical. In this special case, the price function would be equal to the demand function (Freeman 1979).

There are numerous advantages of hedonic pricing cited by its supporters. One of the biggest attractions of the method is its ability to find the underlying inverse demand curve of an environmental good. Additionally, real estate is one of the only markets where environmental quality is traded on a regular basis (Palmquist, 2005) and the market is well researched, with large amounts of data being available for any given house. Hence, real estate offers a unique opportunity for which the price of a good is determined by environmental quality and enough data exists on other aspects of the good to isolate the effect of the environment on price.

Other Valuation Methodologies

Travel Cost Method

Although hedonic pricing and contingent valuation are often the methods most used by the EPA in drafting the cost-benefit portion of a regulatory impact assessment, there are numerous other methods for valuing environmental goods. One such method is the travel cost method. According to Freeman et al. (2014), this model "have come to play a central role in nonmarket valuation, particularly in terms of informing regulators in setting environmental policy, ex-post cost-benefit analysis, and in natural resource damage assessment cases" (p. 270). These models function on the key insight of Hotelling (1947) that traveling to a location for recreation is accompanied by costs, and the responses of individuals to these implicit costs in

terms of travel frequency can be used to estimate the demand for recreation. Individuals chose where they will go and how frequently they will go to recreational sites based on characteristics of the recreational sites and the costs of visiting the site. A simplified travel cost model has an individual who maximizes their utility subject to monetary and time constraints (Clawson et al., 1966). Wages are used as an estimate of the opportunity cost for an individual, as it is assumed the individual could have been working had they not been recreating. So, the demand for visits is a function of exogeneous income, environmental quality at the site, and the cost of the visit. There are numerous methods, such as Censored Regression models (Hellerstein & Mendelsohn, 1993), Multiple Site models (Haab & McConnell, 2002), and the Repeated Rum model (Morey, 1999), Multivariate Count Data models (Ozuna & Gomez, 1994), and the Kuhn Tucker model (Wales & Woodland, 1983) which build upon this simplified concept, but all use travel to recreational sites as a means to arrive at the value of the site to the population (Freeman et al., 2014).

There are a few assumptions inherent in the recreation demand model. One is that all visits to the site were the same time in length, an assumption that is often wrong and modified in more complex models. Additionally, it is assumed that no utility was obtained in traveling to the site, which is not always the case (take for example a scenic drive through the mountains on the way to Rocky Mountain National Park). The method also is unable to account for multiple destination trips, which introduces error as only the incremental travel cost of visiting the site should be factored into the model, but instead the whole cost of the trip is included. It is also assumed that an individual's decision on where to live is independent of the recreational sites nearby. Were it the case that people chose housing locations based on proximity to recreational sites, the price of a visit would be endogenous and undermine the basic frame work of the travel

cost method (Freeman et al., 2014, p. 292). Despite these limitations, the travel cost method remains a popular means of valuing recreational sites.

Benefits-transfer Method

Agencies seeking to perform "quick and dirty" cost-benefit analyses can choose to implement the benefits-transfer technique. The basic theory underlying benefits transfer is that the valuation of an environmental amenity can be transposed to the same environmental amenity in a different location or time period. This extrapolation allows researchers to leverage past work to arrive at estimate of costs and benefits without having to implement one of the methods discussed previously. Benefits transfer is extremely relevant to cost-benefit analysis in the rule making framework. Johnston et al. (2015) in their comprehensive book on the topic affirmed that "Among its many uses, benefit transfer is a virtually indispensable—and some have argued nearly universal—component of large-scale cost–benefit analysis" (p. v). Note that benefits transfer uses estimates that were constructed using the methodologies that were discussed previously. Therefore, any limitations or biases of those models will be present in a benefits-transfer estimate that relies upon estimates derived through those methods.

While it can be assumed that society will have a similar willingness to pay for two environmental goods that are similar in most characteristics other than location, there are numerous factors that could cause the willingness to pay for the two goods to diverge. In general, the degree of accuracy of benefits transfer is directly related to the degree of difference between the comparison site and the site of interest. The two locations or scenarios may differ from the supply side (the quality of environmental quality at the location differs) or from the demand side (the income, preferences, demographics of those who hold value for the environmental good) (Smith, 2018). In most cases, the analyst will use a valuation from the study site that most

closely resembles the site of interest, but the analyst may also use some sort of average (perhaps weighted by judgement of similarity) of studies from a number of locations. If the comparison study occurred in a different year, adjustments for inflation can be made to the comparison willingness to pay. Similarly, if the income of the population at the site of interest differs greatly from the income at the comparison site, the comparison willingness to pay can be adjusted using the income elasticity of willingness to pay (Flores & Carson, 1997). If the researcher has access to the willingness to pay function, they can account for demographic differences between the comparison site and site of interest by inputting into the willingness to pay function the mean values of the relevant characteristics for the site of interest's population (Freeman et al., 2014, p. 421). At the most basic level, benefits transfer values an environmental good using the valuation of a similar good in an original study or studies, and altering the valuation based on the differences in population of interest and time of valuation.

Substantial Biases

Overview

In their book analyzing cost-benefit analysis in the policy space, Revesz and Livermore (2008) hold that "Pricing, a mechanism used to allocate society's resources, is the most effective way to aggregate information and allocate scarce resources to produce the most benefits" (p. 13). However, this is only true if these estimates are accurate. Inaccurate estimates would serve as misinformation in the policy debate and could distract policy makers from pursuing useful regulations or alternatively striking down undesirable regulations. The central premise of the advocates of cost-benefit analysis is that the practice consolidates and summarizes knowledge surrounding preferences of individuals (Revesz and Livermore 2008; Sunstein 2018). This premise is only true if the methods for determining the costs and benefits of a regulation are

accurate. As the regulatory review advising document Circular A-4 states, “a number based on a poor quality study is not necessarily superior to no number at all” (OMB 2003). What follows is a discussion of the difficulties in implementing, as well as the theoretical controversies surrounding, two of the most common methods of valuation of environmental services, hedonic pricing, and contingent valuation.

Stated Preference Methods

There are many conflicts surrounding the theoretical underpinnings of stated preference techniques such as contingent valuation. One of the most vocal critics of contingent valuation went so far as claiming “that contingent valuation is hopeless” (Hausman, 2012). Contingent valuation had become such a contentious technique mainly due to its application in litigation. Contingent valuation has been used in legal proceedings to support environmental damages in the billions of dollars. One court case in particular, the case involving the oil spill from the Exxon Valdez, brought contingent valuation into the public eye. Exxon spent millions trying to discredit contingent valuation, as contingent valuation could be employed to support the existence of large non-use values associated with the Prince William’s Sound (Loomis, 2000). However, in 1993 a NOAA panel headed by 2 Nobel laureate economists ultimately ruled that contingent valuation could be used in the Court Room. Additionally, the publication of the book *Using Surveys to Value Public Goods: The Contingent Valuation Method* by Richard Carson and Robert Mitchel helped to standardize the techniques of contingent valuation, adding reputability to the practice. However, even if the method itself is permissible in judicial and policy processes, contingent valuation can still be employed incorrectly, as will be discussed next.

A potential source of error present in the contingent valuation model is double counting. Double counting would occur if the value parents placed on protecting the environment for their

progeny and the value placed on the environment by the progeny themselves were both included in the calculation of total surplus associated with the environmental good (EPA and Carlin, 1992). Assume there is some environmental resource, and a researcher incorporates use values of this resource beyond the time horizon of the current generation. If a researcher does not eliminate the bequest value of the first generation from the model, then they will effectively be counting the value to the second generation twice, once as a bequest value from the first generation and once as a use value (Madaringa & McConnel 1987). Hence, an inability in stated preference models to isolate and remove paternalistic altruism would contribute to an upward bias of the consumer surplus stemming from the ecosystem good or service.

Another criticism of stated preference techniques is that the value it estimates is not based on actual behavior (Carson & Hanemann, 2005). It has been demonstrated that actual contributions by individuals often are far less than what survey results from contingent valuation would indicate. However, this pattern does not undermine the credibility of contingent valuation, as the free rider problem in the allocation of public goods explains the low observed contributions of individuals to protect or acquire those public goods (Carson & Hanemann, 2005). Additionally, the warm glow effect of donating can lead to increased Hicksian values of a public good, as the actual Hicksian measure of willingness to pay will be lower than the Hicksian value of the marginal willingness to donate (Chilton & Hutchinson, 1999). These issues of the stated willingness to pay not equaling the actual payments is the basis for the majority of attacks against contingent valuation (Svedsäter, 2003). It has been reported that three-fourths of all such studies that compare actual versus survey behavior find actual payments to be less than stated willingness to pay amounts found through surveying (Freeman et al., 2014).

Another serious theoretical issue present in contingent valuation is the divergence of willingness to pay and willingness to accept estimated by the method. Two early studies demonstrated that willingness to pay and willingness to accept figures differed drastically (Carson and Hanemann 2005). Often in valuation of environmental services using contingent valuation, willingness to pay is assumed to equal willingness to accept and the two estimates are substituted. However, the usual empirical finding is that the willingness to pay for a change in environmental quality is several times smaller than the willingness to accept such a change (Knetsch, 1990). A possible explanation for this phenomenon is that individuals evaluate alternatives in terms of loss or gain from an initial neutral reference state. Initially, holding property rights causes individuals to value losses from this reference state more than gains from the reference state. Some critics of the contingent valuation hold divergence of willingness to pay and willingness to accept as evidence of the invalidity of contingent valuation. The logic of these critics is that if the willingness to pay and willingness to accept determined through surveying differ, then surveying as a technique must be flawed. Additionally, they argue that without the assumption that willingness to pay equals willingness to accept, the standard Hicksian measures of welfare maximization are impossible (Hausman, 2012). This is because the gains made by the winners of a potential regulation may be less than the compensation necessary to appease the loser, even if the willingness to pay for the good of the losers was less than the winners.

However, the divergence of willingness to pay and willingness to accept observed in contingent valuation is taken by others to reflect a psychological reality of real market transactions, rather a flaw embedded in the contingent valuation framework. For example, it has been observed experimentally that when subjects are given an item (such as a coffee mug), they

will consistently require significantly more money to return the item than they would pay if the item was presented to them and they were asked to purchase it (Kahneman et al., 1990). The ratio of willingness to accept to willingness to pay observed experimentally through survey results has been found to be similar to that observed or even lower than actual transactions, supporting that contingent valuation does give an accurate representation of the two measures (Horowitz & McConnell, 2002). Some have concluded from these findings that the divergence of willingness to pay and willingness to accept in contingent valuation is not evidence of the inaccuracy of the method, but instead a suggestion of the limitations of the Hicksian model (Sugden, 2001).

Even if the difference between willingness to pay and willingness to accept present in contingent valuation is true to reality, there are still numerous implications of this divergence in the context of cost-benefit analysis. The consequence of this bias is that researchers would underestimate losses if they employed a method that used willingness to pay to determine the change in welfare (Carson et al., 1996; Knetsch, 1990). If a policy that allowed for increased environmental degradation was being assessed, finding, and employing willingness to pay through contingent valuation would undervalue the costs borne by society, potentially leading to the implementation of harmful policy. Therefore, the most important consequence of the divergence is it serves as evidence that welfare measure is partially determined by property rights (Carson & Hanemann, 2005).

Another potentially enormous source of error in contingent valuation is improper survey design. A systematic error in the design of a contingent valuation survey occurs when not enough context is provided by the administrator to the respondent. This error can be reduced by conducting focus groups in advance to determine the knowledge and attitudes of a population

towards a particular good or regulation. An additional consideration researchers must be aware of is that survey respondents will often take social cues from administrators, possibly biasing the results in order to please the investigators. This cue may come in the starting point of a bidding game. Another difficult decision faced by a researcher implementing contingent valuation is whether to include negative willingness to pay amount or zero willingness to pay values. Additionally, a researcher has to decide whether to impose a cap on response amounts that are larger than the individual's income. On top of all these choices, a researcher must decide what is to be done if a survey respondent indicates "don't know" to a question. Should this be treated as a zero or be omitted? A researcher must be extremely careful when designing a contingent valuation survey in order to tease out useful willingness to pay estimates.

If the researcher chooses to implement a parametric estimation of the distribution of willingness to pay, they could incorrectly assume a distribution. A researcher has to choose from normal, log-logistic, or Weibull distributions, each of which assume different sizes of tails and will change the mean of the willingness to pay (Carson & Hanemann, 2005). Such incorrect assumption of the distribution of the willingness to pay figures of a population could lead to improper statistical inference. This issue demonstrates that errors in contingent valuation do not just arise from how a survey is designed or implemented. In contingent valuation the responses of a survey become data that is manipulated econometrically to arrive at a willingness to pay figure. Even if a survey is designed and conducted perfectly, working with the data to gain insight into welfare changes due to environmental degradation or protection can be done incorrectly.

Revealed Preference Methods

Revealed preference methods also have come under attack for incorrect assumptions and potential for misspecification. In a review of the use of hedonic pricing models to value the impact of air pollution, Freeman (1979) found that in most studies "the selection of explanatory variables seems to be almost haphazard. Convenience and data availability appear to be the major determinants of this part of model specification" (p. 169). Another study conducted by Harrison and Rubinfeld in 1978 experimented with differences in the specification of the hedonic model for valuing air pollution. Their study employs the expansive Boston housing data set, which includes many different neighborhood variables. They find that changing the specification of the hedonic pricing equation can cause estimates for benefits to differ by as much as 60 percent (Harrison and Rubinfeld 1978, p. 98). For example, just changing the variable of interest for air pollution to the log of that variable causes the average benefits to decline by over 20 percent (Harrison & Rubinfeld, 1978). It is troubling that researchers have found most studies apply control variables in a haphazard fashion, and additionally that specification of a model has a large impact on the estimated benefits.

One assumption of the hedonic pricing model that has come under fire is that the model assumes consumers choose among consuming at all levels of a given characteristic of a house. Some aspects of a house are discrete rather than continuous. For example, the number of bedrooms is obviously not a continuous variable. This is potentially an issue because the hedonic model assumes that the implicit price function is differentiable and continuous (Freeman et al., 2014, p. 324). Furthermore, there are a finite number of houses, and it is unlikely that consumers could have found identical houses with the exception that the homes differed in a single characteristic (Hammack and Brown Jr. 2017). In fact, there might be large gaps in the locus of a particular attribute, resulting in some buyers not being able to satisfy equality of their first order

conditions (Freeman, Herriges, and Kling 2014, p. 326). There may not be any one-bedroom units on one acre lots or houses with four car garages that are one story. A discrete choice model can be employed to avoid this issue, but use of this technique introduces other issues, such as requiring the strong assumption of the functional form of a utility or bid function (Braden et al. 1989, p. 119).

As discussed in the review of the theory underlying the hedonic pricing model, one of the most key assumptions necessary to derive the demand function from the hedonic price function is the shape of the supply curve for the environmental good (Freeman, 1979). Often it is assumed that the supply of that attribute in houses is unaffected by price, or that the supply of the environmental quality of a neighborhood is perfectly inelastic with respect to price. This assumption indicates that if the price of an environmental attribute, say air quality, rises, then suppliers will not build more houses in areas with better air quality. Consider this scenario demonstrating why this assumption could be problematic. Say that consumers value air quality and will pay more for houses of higher air quality. An increase in the quantity supplied of clean air houses would result in a decrease in the price gap between clean air and dirty air houses. However, if it was assumed that supply was inelastic, the change in the price difference of dirty and clean air houses would be attributed to demand. The ultimate result of this for hedonic pricing is that if supply was incorrectly assumed to be perfectly inelastic, the marginal willingness to pay for clean air would be underestimated. The rationale behind the assumption of exogeneous supply is that housing suppliers can only respond slowly to changes in price, but there are instances in regions of rapid growth where this assumption could introduce error into the model.

Among one of the most difficult and controversial assumptions of hedonic pricing is the functional form of the hedonic price function. This function is the relationship between the equilibria of consumer's willingness to pay and supplier's cost and profit functions (Freeman et al., 2014). Some early researchers assumed that individuals' utility functions were linear while other applied transformations to the dependent variable to result in flexible forms (Goodman, 1978; Rosen, 1974). For example, Rasmussen and Zueklke (1990) suggest transforming the price and explanatory variables of the hedonic model with a Box-Cox transformation, which was demonstrated to reduce the sum of squared residuals by about 30 percent (p 436). However, while changing the functional form of the hedonic price function may reduce the error term, it has been demonstrated elsewhere that changing the functional form of the hedonic price function has only a small impact on the final change in welfare estimate (Freeman, 1979). So, while of theoretical interest, the question of the shape of the hedonic price function may be less important than other issues in this section.

Another theoretical limitation of the hedonic pricing model is that to derive the demand curve from the market transactions, one must assume that each individual has the same demand, differing only by the control variables included (income, race, age, etc.) (Freeman, 1979). This is because is an infinite number of demand functions that can go through a single point represented by a market transaction, and only by assuming identical demand can the locus transactions be used to estimate demand. Another problem with the demand function is that the demographic controls used to arrive at the demand function from the hedonic pricing function are likely not available at the household level (Palmquist, 2005, p. 16). Demographic data are only widely available at the census-track level, and so errors will be present when using this census-track level data to represent individual households, who could be very different demographically from

the average for a neighborhood. This could additionally bias the derivation of demand. Were demand not correctly estimated, the willingness to pay for all individuals could be grossly misrepresented.

Additionally, the nature of using home prices as a proxy for how individuals value the environment presents issues. Hedonic pricing models are unable to account for environmental improvement or deterioration in locations other than places of residence. This results in the underestimation of the willingness to pay for environmental goods that alter the lives of individuals regardless of where the individuals reside. The reliance on home value creates another issue. The use of hedonic pricing techniques often inflates the importance of the willingness to pay of homeowners. The use of hedonic pricing necessitates a fixation on policies that affect home price, and a general disregard for policies that would not affect home price. The preferences of those who are not homeowners are not incorporated into valuation under hedonic pricing and can be minimalized.

So, which is more accurate, revealed or stated preference techniques? One of the largest reviews of its kind, Carson et al. reviewed 616 comparisons of CV estimates to revealed preference estimates from 83 separate studies. The finding was that the ratio of contingent valuation estimates to revealed preference estimates was 0.89 with a 95 percent confidence interval from 0.81-0.96 (Carson et al., 1996). The Pearson correlation between the estimates from contingent valuation and revealed preference was between 0.60 and 0.98, depending on whether outliers were cut. This correlation supports the validity of the convergence of the two approaches in valuing a public good. However, the issue with using stated and revealed preference methods as checks for one another is that neither represents the actual value. Many authors claim that revealed preference is the actual value since it is based on actual behavior. In

this line of reasoning, stated preference methods are inaccurate if they differ too greatly from estimates achieved through revealed preferences. However, as discussed previously, revealed preference methods cannot account for nonuse values, and so differing estimates gained through stated and revealed preference methods would be expected in cases of large nonuse values. When employing these methods in cost-benefit analysis, agencies must be aware of the strengths and limitations of each approach and be able to reconcile possible differences in estimates.

Institutional Biases

Since the inception of the modern regulatory review apparatus with Executive Order 12291, as much criticism has been given to how cost-benefit analysis is used in the policy process as has been given to how these valuations are calculated. As Shapiro (1994) writes, "if political oversight is a good thing, then it is possible to have too much of a good thing" (p. 45). Those who typically are most critical of the use of cost-benefit analysis in the policy process are those most for environmental legislation, and those most supportive of the practice are those against regulation (Driesen, 2006). This dichotomy suggests that cost-benefit as applied in the regulatory process is not as unbiased as advertised by its advocates. This section will present the numerous short comings of the current application of cost-benefit analysis in the policy process.

Critics of the current workings of regulatory review argue that OIRA has become too powerful, taking away from the respective power of regulatory agencies. As the first head of OIRA, James C Miller, famously said, "If you're the toughest kid on the block, most kids won't pick a fight with you. The executive order establishes things quite clearly" (Morrison, 1986, p. 1059). OIRA has powerful options at its disposal, such as delaying agencies budgets or effectively prohibiting an agency from publishing rules in the Federal Registrar (Livermore, 2014). Although an agency is technically allowed to publish regulations in the Federal Registrar

without OMB approval, in practice such open defiance of the White House rarely occurs (Shapiro, 1994). Spurning the review process could lead to retaliatory actions by OIRA, such as intentionally slowing down the review of the transgressing agency's other rules. The OMB also reserves the power to refuse to clear the agency for congressional testimony or to reduce the agency's budget when sent to congress (Shapiro, 1994). It is through de facto veto that OIRA and OMB maintain a vice grip over the regulatory process, blunting the power held by the individual agencies.

Although OIRA can be very powerful when it chooses to return a rule to an agency, the regulatory review body wisely does not interfere in every ruling. This is because exercising its power requires expending political capital. As a key but anonymous OMB official revealed in an interview, it requires "too many bureaucratic chips" to make a fuss regarding a rule and to "bring in the heavies" too often (Olson, 1984, p. 45). OMB is therefore selective in the rulings it decides to take issue with. However, just by reviewing and returning some of the rules, OIRA can instigate changes to policy through the fear of adverse review. Agencies are aware that OIRA will occasionally take issue with a given regulation, and this awareness leads agencies to draft policy in a way which they believe will be acceptable to OIRA. Often the agency heads will communicate with the OMB in advance to determine whether certain rules will be found acceptable (Driesen, 2006). In the establishment of National Air Quality Standards, OMB was giving input over a year before any rule was even proposed by the EPA (Olson, 1984). OIRA can hence influence all regulation even if it does not review or return all rules, as the fear of return will be in the back of the minds of those at agencies like the EPA, altering how they draft regulations.

It is not immediately problematic that OIRA has power in the rulemaking framework. It is how and why this power is wielded by OIRA that is problematic to the many critics of OIRA. There has been a long history of OIRA being a force pushing regulations to become less stringent. Jim Tozzi, one of the early officials at OIRA and a prominent figure in shaping the role and scope of the agency, said that OMB has a “loving bias against regulation ... a rebuttable presumption against regulation” (Olson, 1984, p. 43). In 2003, of the 17 rules that were significantly changed during the review process, none became more stringent during revision (Livermore, 2009). When reviewing EPA rules, it has been found that between 45 and 75 percent of rules will be altered during the review process (United States. General Accounting Office., 2003). By ensuring that the policy of various agencies becomes less stringent, the OMB is leading to diminished health protection at the expense of further benefits to industry. For example, officials at the Department of Transportation stated in an interview conducted by the General Accounting Office that “they will not even propose certain regulatory provisions because they know that OIRA will not find them acceptable" (United States. General Accounting Office., 2003). Actors at OMB, wielding great power bestowed by executive order, are able to act on their antiregulatory bias to check the agencies in their policy aims.

The EPA in particular has always been subject to increased scrutiny by OIRA. A OIRA official in an interview in the 1980s admitted to giving “special attention” to analyses sent by the EPA (Olson, 1984, p. 42). Another OIRA administrator said in a hearing before a House subcommittee, "There are scores, hundreds of regulations on the books that are imposing costs without much positive results in terms of environmental or health improvements” (United States. Congress. House. Committee on Government Operations. Manpower and Housing Subcommittee., 1983). Anti-environmental attitudes at OIRA contribute to partial treatment of

EPA rules in the review process. The grudge between OIRA and the EPA has on occasion even become personal. Chief of Staff at the EPA John Daniels testified before congress that he received a call late one evening from an OIRA official who said, “words to this effect[:] that there was a price to pay for doing what we had done, and that we hadn't begun to pay” (United States. Congress. House. Committee on Energy and Commerce. Subcommittee on Oversight and Investigations., 1984). Relations between the EPA and OIRA have become more hospitable since the 1980s but there are still recent examples of friction between the agencies. Ken Kopocis, who leads the Office of Water at the EPA, said in 2015, “OIRA is full of capable people. But they don’t know as much as the agency does” (*How the Trump Administration Is Reshaping the EPA*, 2017). Unfair treatment of EPA rules by OIRA leads to detrimental outcomes, as EPA must tread with extra caution when drafting rules, pushing regulations to become less stringent. The validity of the premise that cost-benefit analysis provides a fair means of comparing the welfare potential of regulations seems suspect in light of the expressed attitude of OIRA officials to the EPA and regulation in general.

The ties to industry have gotten better over the years, but the issue of officials at OIRA maintaining connections to industry is still relevant. In a congressional hearing on OMB review of environmental regulation, John Daniel, the chief EPA Administrator under Reagan, accused OMB of giving proposed rules to industry and incorporating the comments of industry into reviews. Daniel asserted that, “when regulations that we sent to OMB were the subject of communications with OMB, in which it seemed that the feedback we were getting from them was more analysis from the intended regulatee than from OMB staff” (Revesz & Livermore, 2008, p. 28). Industry connections to OMB cause the review process to skew towards less stringent regulations, as industry interests lobby administrators for favorable reviews and

changes. The former EPA General Counsel commented that an attorney is incompetent if they do not lean upon the OMB for reviewing cost-benefit analysis in a manner that is in the client of the attorney's best interests (United States. Congress. House. Committee on Government Operations. Manpower and Housing Subcommittee., 1983). While increased standards of transparency necessitated in Clinton's and Bush's executive orders restrained OIRA from becoming too friendly with industry interests, under the Trump administration the trend of increased separation between OIRA and industry was reversed. Under executive order dating back to Clinton, OIRA must make public meetings with industry involving discussions of proposed rules. During Trump's tenure there was an increase in the meetings per each reviewed rule compared to the Obama and Bush administrations (Potter 2022). The increased transparency requirements imposed under Bush and Clinton helped to create separation between industry and OIRA, but private industry altering the results of cost-benefit analysis review through lobbying still needs to be addressed.

An issue often raised is that the staff at OIRA is comprised mostly of economists and these economists often decide and revise rules which are scientific in nature (Arrow et al. 1996). Many rules which are analyzed by the staff at OIRA involve complex scientific problems, for which officials lacking experience or knowledge in these fields will attempt to answer. The second-guessing of agency staff who possess adequate knowledge to have recommended and drafted these policies in the first place could hinder the incorporation of relevant information into regulations. For example, OMB sought to make the EPA cutoff for carcinogens more lenient, promoting a 1 in 100,000 risk of contracting cancer, despite the objection of scientists at the EPA (McGarity, 1991). The small budget and size of OIRA in comparison to the number of rules that require review results in economists analyzing RIAs for rules that may be outside their area of

expertise. This would not present an issue if the economists were just commenting on specific techniques used in the valuation, but often the review will include comments on specific scientific issues about which the reviewer has limited knowledge (Driesen, 2006). The anti-regulatory leanings of some officials of OIRA result in the politicizing of technical issues, typically biasing what should be scientific concerns in a way that is more favorable for industry (Olson, 1984).

Even if conducted in a perfectly unbiased manner, OMB review of rules can hinder the implementation of beneficial policy through adding friction to the regulatory process. Often the review process of major rules is measured in months rather than weeks (United States. Congress. House. Committee on Government Operations. Manpower and Housing Subcommittee., 1983). There have been examples of regulations being stuck in limbo for over a year while OIRA conducts its review, such as in the case of the EPA's High Level Radioactive Disposal rule (Olson, 1984). There is no effective time limit for review, and it is often the case that the rules submitted by the EPA take the longest to process (Olson, 1984). The delay time to pass regulations which are beneficial to society can result in negative outcomes. Say the EPA wants to enact a rule which could potentially save lives. The delay of the implementation of this rule by OIRA could result in deaths during that processing time period. For example, it has been found that OIRA delays for a OSHA benzene standard resulted in an additional 30-490 leukemia deaths (Nicholson & Landrigan, 1989). The delays result in longer exposure to hazards that could be eliminated. Additionally, the delays give industry more time to operate in an unregulated setting, allowing them to make more profits in the short run. There is no evidence that industry leans upon OIRA to delay regulations but given the degree of familiarity between OIRA officials and industry interests, this scenario is possible (Driesen, 2006).

Furthermore, the regulatory review process has also been portrayed by many as undemocratic. The Head of OIRA is not required to answer to Congress and can operate in opposition to the desires of the legislature (United States. Congress. House. Committee on Energy and Commerce. Subcommittee on Oversight and Investigations. 1984). While some have argued that cost-benefit analysis is more democratic in its ability to estimate the preferences of all individuals (Arrow et al., 1996), others have pointed out that it is impossible to separate cost-benefit analysis from the values of the economists who construct and review the RIAs. Cost-benefit analysis tends to remove the public from the policy process. For instance, the majority of the American public has little knowledge about this important instrument in regulatory review. It has been found that only 16 percent of voters approve of the concept of the value of a statistical life, central to many cost-benefit analyses (Goodwin 2021). This overwhelming majority of Americans who disapprove of the monetization of risk in the regulatory practice are likely unaware that such a method is employed each time a major environmental or health and safety ruling is enacted. The technical nature of cost-benefit analysis and the confusing role of OIRA isolates the practice of regulatory review from the American public.

The democratic process is not just a means of determining preferences of individuals, but also a way of altering the preferences of individuals. Through participating in the democratic process, members of society learn more about an issue, better informing their preferences and allowing for more efficient outcomes. As Sagoff (1994) argues, “At its best, democratic expression works not by aggregation but by deliberation. The values emerging from democratic decision-making are supposed to differ from those entering it; the capacity of political debate to transform view even lends legitimacy to the political process” (p. 136). By estimating the preferences of individuals through passive methods such as hedonic pricing or a limited-sample

contingent valuation, cost-benefit analysis can prohibit the valuable function of informing society served by the democratic process. In the democratic process, the necessity to confront issues at the ballot box leads individuals to reflect upon how they value the issue and form more concrete preferences. No such deliberation is required in valuation.

Finally, there is the question of whether the actions of OIRA to influence policy are legal. The executive orders issued by Reagan and then the proceeding Presidents explicitly prohibit OMB from replacing the decision-making capacity of the agencies, but as noted above OMB clearly has developed pathways of altering the policy process and undermining the autonomy of the various agencies. Congress has given the EPA administrator decision-making discretion and it has been argued that regulatory review through executive action is a breach of the separation of powers, a clear overreach of the executive branch (Olson, 1984). Congress has refused to pass any laws that would legitimize executive oversight of the rule making process, in spite of the efforts of every president since Reagan to pass such a law (Olson, 1984). OMB claims that the Paperwork reduction act of 1980 and the Budget and Accounting Act of 1982 give it the legal authority to have oversight over EPA rules, but nowhere in either act is there any explicit mention of forming a regulatory review system through OMB. Regarding the Paperwork Reduction Act, the Senate Committee report gives the opposite impression, that the legislature did “not intend that 'regulatory reform' issues which go beyond the scope of information management and burden be assigned to the Office” (S. Rep. No. 930, 96th Cong., 2d. Sess. 8-9 1980). In fact, there have been instances during which Congress has suspended funding to OIRA as a means of checking executive overreach (Livermore, 2014). The violation of separation of powers and extension of executive authority over the regulatory process has numerous negative implications.

Philosophical Biases

Should benefits larger than costs always justify a regulation? It seems difficult to argue against taking an action that contributes to societal welfare. However, there are still many who oppose cost-benefit analysis on normative grounds. Ackerman and Heinzerling (2004), authors of *Priceless: On Knowing the Price of Everything and the Value of Nothing,* assert that, "The benefits of health and environmental protection are vitally important, but cannot be meaningfully expressed in monetary terms. In a word, the benefits are priceless". Kelman (1981) writes just after Executive Order 12291 was issued, "depending on the moral importance we attach to the right or duty involved, cost-benefit questions may, within wide ranges, become irrelevant to the outcome of the moral judgment" (p. 36). The issue for those who oppose valuation on moral grounds is that there exist certain rights that transcend monetary value. Freedom of speech, clean air, or the existence of an endangered species might fall into those categories. That is, for some individuals, environmental amenities are rights and not goods. Many hold "the morally right act" as "the act that reflects a duty or respects a right" (Kelman, 1981, p. 36). So, if cost-benefit analysis suggests that infringement upon a right will add to society's welfare, some would say such analysis is inherently immoral.

Although economists might view valuation in the policy process as the only rational choice from an economic perspective, the use of cost-benefit analysis implies support for a utilitarian perspective, which is a philosophical choice. As Kelman notes, "economists who advocate use of cost-benefit analysis for public decisions are philosophers without knowing it" (pp. 33-44). For a utilitarian, the action that adds the most to human satisfaction given the constraints of the world is the moral action. However, consider these examples testing the validity of utilitarianism. Consider a scenario in which there are two policies that achieve the

same level of overall happiness in the country, but one of the policies involves some component of racial injustice, while the other does not. From a utilitarian perspective, there is no difference between the two policies, as both achieve the same level of utility (note this is a hypothetical, it is most likely the case the racial injustice detracts rather than adds to social welfare, but in this case the key assumption is that utility of the two policies is the same). Hence, a policy maker would be indifferent to the choice (p. 35). For many individuals, there are certain morally right actions for which the costs outweigh the benefits and, vis versa, many instances where the benefits of a morally wrong action outweigh the costs. As Kelman observes, "we would not permit rape even if it could be demonstrated that the rapist derived enormous happiness from his act, while the victim experienced only minor displeasure" (p. 35). Similarly, society might not permit the destruction of the habitat of an endangered species, even if the costs far outweigh the benefits which can be measured in dollars. The environment might be viewed by society as above monetization, as serving as a right to be preserved rather than as a good to be marketed.

Additionally, the question of whether private preferences are the same as public preferences is important to the morality of cost-benefit analysis. In cost-benefit analysis, it is assumed that an individual's inclination to make a private decision is the same as their inclination to make that decision in a societal setting. However, many are quick to point out that this is often not the case in reality. These critics of the private and public equivalence of preference suggest that, in a public setting, individuals are more likely to stand up for universal principles. For example, someone who is guilty of racial prejudices could be in favor of pro antidiscrimination laws; a person who does not wear their seat belt might be for a law requiring the wearing of seat belts, or a person who works a job that entails higher risk might be vehemently opposed to placing a monetary value on a human life (Kelman, 1981). A public

decision might be the chance to adhere to principals that an individual doesn't always follow in their private actions. If it were the case that individuals act differently when making public versus private decisions, using private decisions to infer the cost and benefits of public decisions would be erroneous.

Although there are requirements in the current regulatory review framework that necessitate non-monetary considerations be evaluated alongside cost-benefit analysis, the importance of cost-benefit analysis in Executive Order 12291 and its successors tend to emphasize the monetary implications of a regulation. One of the largest non-monetary concerns is distributional impacts: who must bear the costs and who should receive the benefits. Executive Order 12866 does mandate "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)", but costs and benefits are still presented as the largest concern (Exec. Order No. 12866, 1993). The order gives little direction on how to balance issues of equity and welfare maximization. For example, in the cost-benefit analysis guidance documents given to the agencies, only two paragraphs are dedicated to discussing how to consider distributional impacts (Revesz & Livermore, 2008, p. 181). What has been observed in practice is that OIRA tends to place most emphasis on costs, and then on benefits, and then finally on non-monetary considerations (Livermore, 2014). Distribution is treated as an afterthought by OIRA, as the main concern of OIRA is making the pie as big as possible, not how the pie is split up.

From an ethical standpoint, distribution of costs and benefits can be undermined by valuation because cost-benefit analysis relies upon willingness to pay, and the poor are often unwilling to bear the cost of a regulation that could help their life to a great degree (Revesz &

Livermore, 2008, p. 14). This reality results in cost-benefit analysis being more likely to support regulation that favors the rich at the expense of the poor, as the rich will usually have a greater willingness to pay than the poor, especially for environmental goods. There are ways that the methodology of cost-benefit analysis attempts to determine the difference in ability to pay versus willingness to pay, such as employing a constant value of a statistical life or not subjecting contingent valuation to income constraints. Still, because of the fact that money is an imperfect measure of welfare, policy that could contribute greatly to the overall monetary wealth of society might not contribute to the overall welfare. Some have argued that you could value the preferences for distributional equity and incorporate these values into a cost-benefit analysis. However, as argued by Adler and Posner (2006), "fair distribution is not the same thing as preferences about distribution" (p. 187). Just assessing the preferences of the population for equity will not achieve equity.

There are even policies that would contribute to overall welfare, but distributional concerns might impose issues of injustice. There are regulations that impose small costs to a large population while giving gigantic benefits to a small number of individuals. An example of such regulation might be reduction in exposure allowed in the workplace to vinyl chloride. It was determined in 1974 that the cost of compliance to such a regulation would be $200 million (Ackerman et al., 2004, p. 21). As only 13 vinyl chloride workers die from cancer related to exposure to the chemical per year, employing the standard $1.81 million value of a statistical life would yield a cost-benefit analysis demonstrating costs of regulation that far exceed the benefits. However, the cost born by those 13 individuals is of the greatest possible magnitude, death, whereas the benefits to the rest of society were small decreases in prices for consumer products.

The blindness of valuation to the issue of distributional justice is a striking shortcoming of the practice.

Conclusion

The institutional and philosophical biases of valuation of environmental services in the policy process are often attacked in isolation from the substantial biases of cost-benefit analysis. This is because cost-benefit analysis has been presented as an irrefutable truth. The estimates for the costs and benefits of a regulation are protected by the statistical complexity of the methods that were used to derive them. It is difficult to dispute what is difficult to understand. As Wesley Warren, director of programs at the National Resource Defense Council, once said with respect to OIRA, "NRDC isn't going to change anyone's opinion in there. Environmentalists without PhDs in economics from MIT aren't going to make headway in a room full of neoclassical economists" (Revesz & Livermore, 2008, p. 35). Instead of attacking cost-benefit analysis on technical grounds, groups representing environmental interests are more disposed to disparage the practice on institutional or philosophical grounds. However, the technical limitations of cost-benefit analysis shed light onto the utility and morality of valuing environmental regulations. The technical, institutional, and philosophical issues are intertwined; interacting with, and augmenting one another. The value to the policy process of cost-benefit analysis can only be determined in context of the accuracy and theoretical assumptions of the valuation methods.

The interrelatedness of the political and technical aspects in cost-benefit analysis is evidenced in the popularity of benefits transfer. As discussed previously, benefits transfer is a quick means of cost-benefit analysis that does not require an original study, instead the method functions by extrapolating the result from an original study to estimate the value of an environmental good in a location. The EPA has become increasingly reliant on benefits transfer

as a means of conducting cost-benefit analysis due to its relative ease of use. This is problematic because benefits transfer is only as accurate as the original studies it employs. The desire to achieve cost and time efficient cost-benefit analyses has led to an over emphasis of research into benefits transfer. According to one of the most well-respected voices in the field of environmental valuation John Loomis (2015), "As policy makers and managers (and their cost conscious consultants) become aware of the option of benefit transfer, they may over-emphasize its use, leading to the loss of additional original valuation studies–the very foundation that makes benefit transfers possible" (p. 67). This scenario reflects that the development of new model frameworks and research into existing models is driven by which models are being employed at the agencies and OIRA. Hence, the work of policy makers and economists in the context of cost-benefit analysis are highly dependent. In conducting cost-benefit analyses of environmental services, policy makers are reliant upon the models derived from economists. Economists in turn direct research towards the methods that are preferred by policy makers.

Another confluence of the technical and the political in cost-benefit analysis stems from the political actors' lack of understanding of the accuracy of cost-benefit estimates. The inability of statistical and economic models to perfectly capture reality should dictate that cost-benefit analysis be taken with a grain of salt when drafting and reviewing environmental policy. Freeman (1979), one of the biggest advocates of hedonic pricing, even admits that "The theory is logical and consistent, but it involves a substantial simplification and abstraction from a complex reality. The assumptions are never completely realized in practice". As noted, assuming supply to be perfectly inelastic when employing hedonic pricing, or assuming the compensation variations to be normally distributed when employing contingent valuation are necessary best guesses that might be far from actuality. Economics requires assumptions that simplify reality,

and valuation of environmental goods can still add useful information to the policy process even if it is built on these simplified assumptions. However, cost-benefit analysis is treated in rulemaking as though it was derived through perfect knowledge and represents a single best estimate. As discussed extensively previously, this is far from the case. Estimates are often wrong, as seen in the case of removal of vinyl chloride in which actual costs of compliance were between seven and 25 percent of the estimated costs (McGarity, 1991, p. 269; United States. Congress. House. Committee on Government Operations. Manpower and Housing Subcommittee., 1983). As conveyed by Ackerman et al. (2004), "a rigid insistence on making regulations pass cost-benefit tests would, in retrospect, have gotten the wrong answer time after time" (p. 22). Valuation of environmental regulations would be far more useful and far less damaging if the range and uncertainty of estimates was more openly acknowledged.

An additional consequence of the variability, sensitivity, and accuracy of cost-benefit analysis is a potential for manipulation. Manipulation is a consequence of the fact that the estimates derived through cost-benefit analysis can vary widely depending on what data is incorporated, how survey questions are asked, or how a model is specified. This manipulation of the results of cost-benefit analysis allows politicians to use valuation as a veiled means of achieving partial policy aims. An example of this is to be found in the controversy surrounding the social cost of carbon. Much of the economic cost of carbon emissions, and hence the potential benefits for abatement, will be incurred or opposingly instilled on future generations. The rate by which these future costs/benefits are discounted to present dollar terms is hugely impactful in valuing the cost of carbon emissions. If a policy generates a benefit of $100 one hundred years after it is implemented, applying a 2.5 percent discount rate causes the present value of the benefit to be $8.46, whereas applying a five percent discount rate causes the present

value of the benefit to be only 76 cents. Changing just this one assumption by a 2.5 percentage point increase causes the benefits to become 11 times smaller. For this reason, discounting has become very politicized.

When Trump took office, by executive order he disbanded the group established to determine a social cost on carbon and had all the supporting documents of the social cost of carbon withdrawn, which included numerous studies from Nobel prize winning economists. He ordered that the discount rate for benefits to future generations be raised considerably, greatly reducing the importance of the welfare of posterity to cost-benefit estimates (Livermore & Revesz, 2020, p. 160). The justification of this decision stemmed not from a desire to achieve more accurate cost-benefit analysis, but to implement policy in line with the party platform. This change has gigantic implications, as the size of the discount is hugely influential in the monetization of costs and benefits. A larger discount rate will result in quicker exploitation of natural resources (Weiss, 1984). However, there is a defendable range of values for assumptions like a discount rate, and political actors can guide agencies to work within that defendable range to achieve valuations supporting policies in alignment with their platform or detracting from policies opposed to their platform.

The right side of the aisle is not the only party guilty of this manipulation. In *Corrosion Proof Fittings v. EPA*, the Court found the EPA guilty of having pushed upwards the valuation of benefits for a regulation of asbestos product (1991). The court ruled that the EPA had made empirical choices such as using an unreasonably high value of a statistical life, discounting from the time of exposure rather than the time of injury, and discounting only the costs of the regulation and not the benefits (Eric A. Posner, 2001, p. 1195). This example also demonstrates that both agencies and OIRA have discretion in the choices made when conducting valuation of

environmental services. In most cases, the overall pro-regulatory attitude of the EPA under more liberal institutions clashes against the anti-regulatory attitude of OIRA. However, while the EPA has the ability to push numbers in one direction, OIRA has the ability to challenge and correct the EPA on the misuse of the established cost-benefit analysis framework. The inverse is not true. Should the EPA disagree with the theoretical assumptions and criticism presented in OIRA's regulatory review, there is no clear means to dispute the discrepancy. So, the case is not as simple as cost-benefit analysis being fundamentally deregulatory in nature. The reality is that cost-benefit analysis is open to manipulation, and OIRA has the last say in whether an application of cost-benefit analysis by the agency is acceptable.

69 percent of surveyed respondents publishing on climate change in economics and environmental economics journals believed that the discount rate adopted under the Trump administration was too small, but the discount rate used by Trump is not necessarily incorrect (Howard et al., 2015). This is because the discount rate reflects how much the present generation should value posterity and is as much a matter of philosophy as it is a matter of economics. It is an assumption, according to Revesz and Livermore (2008), that "is fundamentally moral and ethical. It implicates the responsibility of current generations for the welfare of future generations" (p. 101). Use of a larger discount rate is essentially prioritizing the interests of current generations over future generations, which is a value-based decision (Driesen, 2006). A high discount rate minimizes the importance of those future benefits in cost-benefit analysis, potentially restricting the implementation of rules that would be advantageous to posterity. Choosing a high discount rate is a philosophical stance that future generations will be better endowed than previous ones and that human wealth will continue to expand (Weiss, 1984). So, 69 percent of economists surveyed believe that government should value future generations to an

extent greater than allowed under Trump. However, Trump's discount rate is not unreasonable if a person holds that the current generation should be prioritized over the future ones. This example illuminates how many of the assumptions in valuation are not mathematical but ethical. Cost-benefit analysis is meant to assess the value of the environment to society but the values of the researchers that chose inputs or the value of the administration that deems which inputs are acceptable can alter the valuation.

While the current institutional structure of cost-benefit analysis creates the grave potential to cause harm in the rulemaking process, an in-depth analysis of the role of valuation of environmental services demonstrates that cost-benefit analysis also has the potential to assist the democratic process. OIRA is able to keep agencies in alignment with presidential directives, as it serves as a more direct link to the presidential policy agenda (Graham, 2008). Cost-benefit analysis also allows OIRA and the agencies to speak to one another in the same terms, permitting OIRA to effectively oversee a wider breadth of regulations with a limited staff, so long as they stay focused on the economics in the RIAs and not interfere unduly on the scientific side. As long as the American public and the public officials who represent them value government regulating rationally, cost-benefit analysis should remain a part of the regulatory process. However, it would be irrational to claim that cost-benefit analysis should be the only consideration when deciding to implement or not implement a rule. Cost-benefit is limited by the accuracy of the methods it employs, and the biases of the analysts who employ them. Measures are needed to promote more accurate valuation, more honest portrayal of that accuracy to legislators and the public, and more equitable outcomes. cost-benefit analysis has the potential to improve the regulatory process, but the technical limitations, and philosophical considerations that hinder the process need to be addressed for the practice to add value to agency rulemaking.

A grave omission from cost-benefit analysis is consideration of the distributional impacts of regulations. Although current OMB guidelines direct that agencies should "provide a separate description of distributional effects" (OMB 2003), there is no definite rule for when distributional concerns should outweigh the results of a Kaldor-Hicks test. When a non-monetary concern stands in opposition to the monetary valuation of a regulation, it is often the case that interest groups will lobby OIRA to forgo cost-benefit in order to address the non-monetary concern. However, as John Graham, Director of OIRA under Bush, (2008) lamented, he could "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" (p. 520). The economically disadvantaged are underrepresented in the regulatory review framework, and a means is necessary to ensure that they receive equitable treatment.

There have been different proposals for reform to ensure that regulatory review through cost-benefit analysis is more equitable. John Graham and others suggest that a separate Kaldor-Hicks test be implemented for each regulation assessing whether the willingness to pay of the winners among the poor is greater than the willingness to accept of the losers among the poor (Graham, 2008, p. 519). This test would require that the welfare gains among the poor are greater than the welfare losses, leading to regulations that promote economic advancement of the poor. A drawback of this test is that there are certain groups among the poor who might still receive a disproportionate share of costs, merely a narrowed problem of the original sin of cost-benefit analysis. Another solution would be to mandate the inclusion of detailed distributional impacts in an RIA, and to necessitate some sort of tax and transfer system to address distributional inequities (Livermore & Revesz, 2020, p. 206). The main roadblock to this approach is that it falls within the power of Congress to change tax codes, and Congress often does not act to

ensure fair distribution of the pie. At bare minimum, an attitude change is required at OIRA to ensure that distributional concerns are more than a footnote in RIAs. “Experience has amply demonstrated that agencies are unlikely to start spontaneously conducting rigorous distributional analysis on their own”, and there is a pressing need for some future administration to rewrite OMB guidelines for cost-benefit analysis in such a way that reframes distributional issues in the valuation of environmental policy (Livermore & Revesz, 2020, p. 208).

It would also be beneficial for OMB to specify which methods are permissible based on the size of the regulation. The requirement now that RIAs be submitted for regulatory actions that have an “annual effect on the economy of $100 million” (Exec. Order No. 12866, 1993) could be strengthened by specifying exactly what methodologies should be conducted for regulations of different sizes. The rigor of and resources applied to the cost-benefit analysis of a policy should be proportional to the size of the economic impact of that environmental policy. Methods that are more resource intensive should be required only for regulations with a significant impact. For example, it should be clarified that in addition to benefits transfer, an original study for cost-benefits of a regulation should be required if the regulation has economic impact over a certain threshold, such as one billion dollars or five billion dollars. As discussed, benefits transfer adds a layer of uncertainty to a valuation by requiring that an estimate of willingness to pay be transposed between locations or time periods. Even Circular A-4, as currently worded, warns that benefits transfer is “often associated with uncertainties and potential biases of unknown magnitude” (OMB 2003). This layer of uncertainty is acceptable if the cost of an erroneous cost-benefit estimate is small, but in the case of a billion-dollar regulation the cost of such uncertainty is too great to be tolerated. Additionally, past a certain threshold of economic impact it should be required that multiple methodologies be applied in the

valuation of a regulation. Although more resource intensive, using a combination of travel cost, hedonic pricing, and contingent valuation can lead to more accurate valuations. Should there be a reason why only one valuation methodology is appropriate for a particular regulation, the agency should be required to explain why.

Although it is useful to implement changes to regulatory review that common sense or previous research suggests will lead to more accurate valuations, there is a glaring need for some form of retrospective validation of cost-benefit analyses. McGarity and Ruttenberg (2002) propose that "probably the single most important step that agencies could undertake to enhance the robustness of the empirical basis for regulatory cost assessment would be for agencies to commission more retrospective evaluations of past prospective cost assessments" (p. 1999). There is very little ex-post evaluation of the accuracy of cost-benefit analysis, and such work would greatly improve regulatory review. Such corroborative work could expose certain biases within either the agencies or OIRA. Additionally, validation could shed light into which valuation methods are accurate and which need to be improved or avoided. This check would also serve to identify rules for which the costs in reality are far exceeding benefits so that an agency can determine how to alter the rule so as to increase benefits or reduce costs. These benefits need to be balanced against the fact that ex-post analysis can be even more tedious and involved than ex-ante studies (Parker, 2003). Therefore, such retrospective studies should only be required when the economic impact of a regulation surpasses a certain threshold, again likely one billion dollars. By identifying potential errors in how cost-benefit was conducted, as well as identifying potential changes to existing rules, ex-post studies would greatly benefit the regulatory review process.

The treatment of non-quantified costs and benefits should be addressed in order to standardize valuation of environmental services. There are often numerous unquantified costs and benefits of a regulation, and it is difficult to decide when these nonmonetized considerations can overturn the results of the monetized valuation (Parker, 2006). There is no way to know if the unmonetized costs are greater than the unmonetized benefits and how to compare these non-monetary values with monetized considerations (Driesen, 2006, p. 401; Graham, 2008, p. 524). However, in some cases certain benefits could be monetized, were a method invented for doing so. From Court's invention of hedonic pricing, Hotelling's insight into travel costs, or the application of contingent valuation for non-use values, the history of environmental valuation is full of examples of the derivation of methods to price what was previously considered impossible to value. Were it mandated that agencies should keep track of the nonmonetary considerations included in regulatory impact assessments and submit a summary of the considerations to OMB annually, it would be possible for OMB to identify the most important nonmonetary considerations. From there, a research budget should be allotted to find ways to monetize these non-quantified benefits or costs so that future analyses can more accurately weigh these considerations into the cost-benefit framework. The difficulty is that monetization of environmental benefits will almost always entail more uncertainty than the monetization of costs, as environmental benefits often include non-marketable items such as a scenic vista or clean air (Heinzerling, 2001). The aim of a policy maker should be to maximize welfare, not monetary wealth. Monetary wealth can be used as a translation of an individual's welfare, but such translation is imperfect. This reality should be acknowledged in RIAs and made clear to the American people.

There is a reason that cost-benefit analysis in the policy process has survived the many political changes of the last 40 years. Valuation is useful because it allows individual or societal values to be compared and weighed in a common unit, dollars (Hammitt, 2002). If a person were to be asked how many years of their life they would be willing to forgo in order to ensure the preservation of an endangered species, it is unlikely they could give an insightful or accurate answer. The question of how much money they would forgo to save the same species is more easily understood and answered. As Revesz and Livermore (2008) write, "Cost-benefit analysis—the translation of human lives and acres of forest into the language of dollars and cents—can seem harsh and impersonal. But such an approach is also necessary to improve the quality of decisions that regulators make" (p. 3). The costs of environmental regulation are usually in dollar terms, such as the cost of installation of a new smokestack filter for a factory. The benefits are often not directly measured in dollars, such as the reduced risk of mortality from improved air quality, or the knowledge that a pristine ecosystem is being preserved. Some would say this is because these environmental goods are invaluable. However, in the framework of cost-benefit analysis, the invaluable may as well be worthless. By "pricing the priceless", the benefits can be weighed against the monetary costs, and an argument can be made to implement regulation to protect or promote such goods. This is the promise of cost-benefit analysis, but it is a promise that is yet to be reached. Serious reform is necessary to achieve that promise.

References

Ackerman, Frank., Heinzerling, Lisa., Massey, Rachel., & Center for Progressive Regulation. (2004). *Applying cost-benefit analysis to past decisions: Was protecting the environment ever a good idea?* Center for Progressive Regulation; WorldCat.org. http://www.progressiveregulation.org/articles/CB

Adler, M. D., & Posner, E. A. (2006). *New foundations of cost-benefit analysis*. Harvard University Press; WorldCat.org. http://catdir.loc.gov/catdir/toc/fy0704/2006043377.html

Arrow, K. J., Cropper, M. L., Eads, G. C., Hahn, R. W., Lave, L. B., Noll, R. G., Portney, P. R., Russell, M., Schmalensee, R., Smith, V. K., & Stavins, R. N. (1996). Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation? *Science*, *272*(5259), 221–222. WorldCat.org.

Ascher, W., & Steelman, T. (2006). Valuation in the Environmental Policy Process. *Policy Sciences*, *39*(1), 73–90. WorldCat.org.

Bayer, Patrick., Keohane, Nathaniel., & Timmins, Christopher. (2006). *Migration and Hedonic Valuation The Case of Air Quality* (Vol. 1–1 online resource.). National Bureau of Economic Research; WorldCat.org. http://www.nber.org/papers/w12106

Biden, J. (2021, January 21). *Modernizing Regulatory Review*. The White House.

Braden, J. B., Kolstad, C. D., Illinois. Department of Energy and Natural Resources. Office of Research and Planning., & University of Illinois at Urbana-Champaign. Institute for Environmental Studies. (1989). *Measuring the demand for environmental improvement: Final report*. The Office; WorldCat.org.

Carson, R. T., Flores, N. E., Martin, K. M., & Wright, J. L. (1996). Contingent Valuation and Revealed Preference Methodologies: Comparing the Estimates for Quasi-Public Goods. *Land Economics*, *72*(1), 80–99. WorldCat.org.

Carson, R. T., & Hanemann, W. M. (2005). Chapter 17 Contingent Valuation. In *Handbook of Environmental Economics* (Vol. 2, pp. 821–936). Elsevier. https://doi.org/10.1016/S1574-0099(05)02017-6

Chilton, S. M., & Hutchinson, W. G. (1999). Some Further Implications of Incorporating the Warm Glow of Giving into Welfare Measures: A Comment on the Use of Donation Mechanisms by Champ et al. *Journal of Environmental Economics and Management*, *37*(2), 202–209. WorldCat.org. https://doi.org/10.1006/jeem.1998.1062

Commission on Presidential Debates, Debate Transcript, October 28, 1980.

Corrosion Proof Fittings v EPA, 3 947 F2d 1201 (5th Cir 1991)

Clawson, M., Knetsch, J. L., & Resources for the Future. (1966). *Economics of outdoor recreation*. John Hopkins Press [for] Resources for the Future, Inc.; WorldCat.org.

Dan Davidson, Jim Tozzi, Center for Regulatory Effectiveness, Nixon's 'Nerd' Turned Regulations Watchdog, FederalTimes.com, Nov. 11, 2002.

Driesen, D. M. (2006). Is Cost-Benefit Analysis Neutral? *University of Colorado Law Review.*, *77*(2), 335–404. WorldCat.org.

Dooling, B., Febrizio, M., & Perez, D. (2019, September). *Accounting for regulatory reform under Executive Order 13771: Explainer and recommendations to improve accuracy and accountability*. Brookings Institute.

EPA, & Carlin, A. (1992, October). *METHODS FOR MEASURING NON-USE VALUES: A CONTINGENT VALUATION STUDY OF GROUNDWATER CLEANUP*. Environmental Protection Agency.

Eric A. Posner. (2001). Controlling Agencies with Cost-Benefit Analysis: A Positive Political Theory Perspective. *The University of Chicago Law Review*, *68*(4). WorldCat.org.

Executive Order. No. 12291, 1981.

Executive Order. No. 12886, 1993.

Executive Order. No. 13,771, 2017.

Executive Office of the President, *Fiscal Year 2018 Congressional Budget Submission* (Washington: Executive Office of the President, 2017), p. 13.

Febrizio, M., & Warren, M. (2020, July). *Regulators' Budget: Overall Spending and Staffing Remain Stable* (No. 42). The George Washington University.

Flores, N. E., & Carson, R. T. (1997). The Relationship between the Income Elasticities of Demand and Willingness to Pay. *Journal of Environmental Economics and Management*, *33*(3), 287–295. WorldCat.org. https://doi.org/10.1006/jeem.1997.0998

Freeman, A. M., Herriges, J. A., & Kling, C. L. (2014). *The measurement of environmental and resource values: Theory and methods* (Third edition., Vol. 1–1 online resource (xvii, 459 pages)). RFF Press; WorldCat.org. http://site.ebrary.com/id/10879752

Freeman, A. Myrick. (1979). Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues. *The Scandinavian Journal of Economics*, *81*(2), 154–173. WorldCat.org.

Geldis, K. U. T. (2017, February 6). *Trump's Executive Order to limit regulations: What it means for your business*.

Gerstein, J. (2017, April 10). *How Merrick Garland could torment Trump*. POLITICO.

Goodman, A. C. (1978). Hedonic prices, price indices and housing markets. *Journal of Urban Economics*, *5*(4), 471–484. WorldCat.org. https://doi.org/10.1016/0094-1190(78)90004-9

Goodwin, J. (2021, May 8). *To Democratize Regulation, Reform Regulatory Analysis*. The Regulatory Review.

Graham, J. D. (2008). Saving Lives through Administrative Law and Economics. *University of Pennsylvania Law Review*, *157*(2), 395–540. WorldCat.org.

Haab, T. C., & McConnell, K. E. (2002). *Valuing environmental and natural resources: The econometrics of non-market valuation*. E. Elgar Pub.; WorldCat.org. http://digitool.hbz-nrw.de:1801/webclient/DeliveryManager?pid=3052560

Hammack, J., & Brown Jr., G. M. (2017). *Waterfowl and Wetlands: Toward Bioeconomic Analysis* (1st edition., Vol. 1–1 online resource). Routledge; WorldCat.org. http://www.vlebooks.com/vleweb/product/openreader?id=none&isbn=9781317332831

Hammitt, J. K. (2002). QALYs Versus WTP. *Risk Analysis*, *22*(5), 985–1001. WorldCat.org. https://doi.org/10.1111/1539-6924.00265

Harrison, D., & Rubinfeld, D. L. (1978). Hedonic housing prices and the demand for clean air. *Journal of Environmental Economics and Management*, *5*(1), 81–102. WorldCat.org. https://doi.org/10.1016/0095-0696(78)90006-2

Hausman, J. (2012). Contingent Valuation: From Dubious to Hopeless. *Journal of Economic Perspectives*, *26*(4), 43–56. WorldCat.org. https://doi.org/10.1257/jep.26.4.43

Heinzerling, L. (2001). THE CLEAN AIR ACT AND THE CONSTITUTION. *Saint Louis University Public Law Review.*, *20*(Part 1), 121–152. WorldCat.org.

Hellerstein, D., & Mendelsohn, R. (1993). A Theoretical Foundation for Count Data Models. *American Journal of Agricultural Economics*, *75*(3), 604–611. WorldCat.org.

Horowitz, J., & McConnell, K. (2002). A Review of WTA-WTP Studies. *Journal of Environmental Economics and Management*, *44*(3), 426–447. WorldCat.org.

Hotelling, Harold. 1947. "Letter to the National Park Service." Reprinted in An Economic Study of the Monetary Evaluation of Recreation in the National Park Service (1949). US Department of the Interior, National Park Service and Recreation Planning Division, Washington, D.C.

How the Trump administration is reshaping the EPA. (2017, December 19). PBS NewsHour. https://www.pbs.org/newshour/politics/how-the-trump-administration-is-reshaping-the-epa

Howard, P., Sylvan, D., & New York University. School of Law. Institute for Policy Integrity. (2015). *Expert consensus on the economics of climate change* (Vol. 1–1 online resource (approximately 40 pages) : color illustrations). Institute for Policy Integrity, New York University School of Law; WorldCat.org. http://www.eenews.net/assets/2015/12/07/document_cw_03.pdf

Johnston, R. J., Rolfe, J., Rosenberger, R. S., & Brouwer, R. (2015). *Benefit transfer of environmental and resource values: A guide for researchers and practitioners* (Vol. 1–1 online resource (xxiii, 582 pages)). Springer; WorldCat.org. https://doi.org/10.1007/978-94-017-9930-0

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1990). Experimental Tests of the Endowment Effect and the Coase Theorem. *Journal of Political Economy*, *98*(6), 1325–1348. WorldCat.org.

Kelman, S. (1981). Cost-benefit analysis: An ethical critique. *Regulation*, *5*(1), 33–40. WorldCat.org.

Knetsch, J. L. (1990). Environmental policy implications of disparities between willingness to pay and compensation demanded measures of values. *Journal of Environmental Economics and Management*, *18*(3), 227–237. WorldCat.org. https://doi.org/10.1016/0095-0696(90)90003-H

Limehouse, F., Melvin, P., & McCormick, R. (2010). The Demand for Environmental Quality: An Application of Hedonic Pricing in Golf. *Journal of Sports Economics*, *11*(3), 261–286. WorldCat.org.

Livermore, M. A. (2009). *Cause or Cure? Cost-Benefit Analysis and Regulatory Gridlock.* (Vol. 1–1 Online-Ressource (27 p)). SSRN; WorldCat.org. https://ssrn.com/abstract=1367282

Livermore, M. A. (2014). Cost-Benefit Analysis and Agency Independence. *The University of Chicago Law Review*, *81*(2), 609–688. WorldCat.org.

Livermore, M. A., & Revesz, R. L. (2020). *Reviving rationality: Saving cost-benefit analysis for the sake of the environment and our health* (Vol. 1–1 online resource (1 volume)). Oxford University Press; WorldCat.org. https://dx.doi.org/10.1093/oso/9780197539446.001.0001

Loomis, J. B. (2000). TECHNICAL PAPERS - Environmental Valuation Techniques in Water Resource Decision Making. *Journal of Water Resources Planning and Management.*, *126*(6), 339. WorldCat.org.

Loomis, J. B. (2015). The Use of Benefit Transfer in the United States. In *Benefit Transfer of Environmental and Resource Values* (pp. 61–70). Springer Netherlands : Dordrecht; WorldCat.org. https://doi.org/10.1007/978-94-017-9930-0_3

Madaringa, B. and K-E. McConnell, May 1987, “Exploring Existence Values", Water Resources Research. Vol. 23:5:936-942.

Magnuson, E., & Thomas, E. (1983). Three Steps Forward, Two Back. *TIME Magazine*, *122*(9). WorldCat.org.

McGarity, T. O. (1991). *Reinventing rationality: The role of regulatory analysis in the federal bureaucracy* (Vol. 1–1 online resource (xvii, 384 pages)). Cambridge University Press; WorldCat.org. https://doi.org/10.1017/CBO9780511528279

McGarity, T. O., & Ruttenberg, R. (2002). Counting the Cost of Health, Safety, and Environmental Regulation. *Texas Law Review*, *80*(7). WorldCat.org.

Morey, E. R. (1999). Two rums uncloaked: Nested-logit models of site choice and nested-logit models of partecipation and site choice. *Valuing Recreation and the Environment : Revealed Preference Methods in Theory and Practice / Edited by Joseph Herriges and Catherine L. Kling*. WorldCat.org.

Morrison, A. B. (1986). OMB Interference with Agency Rulemaking: The Wrong Way to Write a Regulation. *Harvard Law Review*, *99*(5), 1059–1074. WorldCat.org.

Nicholson, W. J., & Landrigan, P. J. (1989). Quantitative assessment of lives lost due to delay in the regulation of occupational exposure to benzene. *Environmental Health Perspectives; (USA)*, *82*, 185–188. WorldCat.org. https://doi.org/10.1289/ehp.8982185

Office of Management and Budget, (Sept 17, 2003), Regulatory Analysis, Circular A-4.

Olson, E. D. (1984). THE QUIET SHIFT OF POWER: OFFICE OF MANAGEMENT & BUDGET SUPERVISION OF ENVIRONMENTAL PROTECTION AGENCY RULEMAKING UNDER EXECUTIVE ORDER 12,291. *Virginia Journal of Natural Resources Law*, *4*(1), 1–80. WorldCat.org.

Ozuna, Teofilo, & Gomez, I. A. (1994). Estimating a System of Recreation Demand Functions Using a Seemingly Unrelated Poisson Regression Approach. *The Review of Economics and Statistics*, *76*(2), 356–360. WorldCat.org.

Palmquist, R. (2005). Chapter 16 Property Value Models. *Handbook of Environmental Economics*, *2*, 763–819. https://doi.org/10.1016/S1574-0099(05)02016-4

Parker, R. W. (2003). Grading the Government. *The University of Chicago Law Review*, *70*(4), 1345–1486. WorldCat.org.

Parker, R. W. (2006). THE EMPIRICAL ROOTS OF THE "REGULATORY REFORM" MOVEMENT: A CRITICAL APPRAISAL. *Administrative Law Review*, *58*(2), 359–400. WorldCat.org.

Popovich, N., Albeck-Ripka, L., & Pierre-Louis, K. (2021, January 21). *The Trump Administration Rolled Back More Than 100 Environmental Rules. Here's the Full List.* The New York Times.

Potter, R. A. (2022, March 9). *Regulatory lobbying has increased under the Trump administration, but the groups doing the lobbying may surprise you*. Brookings.

Rasmussen, D. W., & Zuehlke, T. W. (1990). On the choice of functional form for hedonic price functions. *Applied Economics*, *22*(4), 431–438. WorldCat.org. https://doi.org/10.1080/00036849000000002

Revesz, R. L. (2021, May 4). *A New Era for Regulatory Review*. The Regulatory Review.

Revesz, R. L., & Livermore, M. A. (2008). *Retaking rationality: How cost-benefit analysis can better protect the environment and our health* (Vol. 1–1 online resource (viii, 254 pages)). Oxford University Press; WorldCat.org. http://site.ebrary.com/id/10476956

Rosen, S. (1974). Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy*, *82*(1), 34–55. WorldCat.org.

Sagoff, M. (1994). Should Preferences Count? *Land Economics*, *70*(2), 127–144. WorldCat.org.

Samuelson, P. A. (1954). The Pure Theory of Public Expenditure. *The Review of Economics and Statistics*, *36*(4), 387–389. WorldCat.org.

Shapiro, S. A. (1994). POLITICAL OVERSIGHT AND THE DETERIORATION OF REGULATORY POLICY. *Administrative Law Review*, *46*(1), 1–40. WorldCat.org.

Smith, V. K. (2018). Benefits Transfer: Current Practice and Prospects. *Environmental and Resource Economics : The Official Journal of the European Association of Environmental and Resource Economists*, *69*(3), 449–466. WorldCat.org. https://doi.org/10.1007/s10640-017-0206-8

Sugden, R. (2001). Alternatives to the Neo-Classical Theory of Choice. In *Valuing Environmental Preferences* (pp. 152–180). Oxford University Press; WorldCat.org. https://doi.org/10.1093/0199248915.003.0006

Sunstein, C. R. (2018). *The cost-benefit revolution*. The MIT Press; WorldCat.org.

Svedsäter, H. (2003). Economic Valuation of the Environment: How Citizens Make Sense of Contingent Valuation Questions. *Land Economics*, *79*(1), 122–135. WorldCat.org.

United States. Congress. House. Committee on Energy and Commerce. Subcommittee on Oversight and Investigations. (1984). *EPA : investigation of Superfund and agency abuses: Hearings before the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, House of Representatives, Ninety-eighth Congress, first session ...* U.S. G.P.O.; WorldCat.org. http://hdl.loc.gov/loc.law/llconghear.84602359

United States. Congress. House. Committee on Government Operations. Manpower and Housing Subcommittee. (1983). *Office of management and budget control of OSHA rulemaking: Hearings before a subcommittee of the Committee on Government Operations, House of Representatives, Ninety-seventh Congress, second session, March 11, 18, and 19, 1982.* U.S. G.P.O.; WorldCat.org. http://hdl.loc.gov/loc.law/llconghear.00013433720

United States. General Accounting Office. (2003). *Rulemaking: OMB's role in reviews of agencies' draft rules and the transparency of those reviews: Report to congressional requesters*. United States General Accounting Office; WorldCat.org. http://www.gao.gov/cgi-bin/getrpt?GAO-03-929

Wales, T. J., & Woodland, A. D. (1983). Estimation of consumer demand systems with binding non-negativity constraints. *Journal of Econometrics*, *21*(3), 263–285. WorldCat.org. https://doi.org/10.1016/0304-4076(83)90046-5

Weidenbaum, M. L., & DeFina, R. (1978). *The cost of Federal regulation of economic activity*. [American Enterprise Institute]; WorldCat.org.

Weiss, E. B. (1984). The Planetary Trust: Conservation and Intergenerational Equity. *Ecology Law Quarterly*, *11*(4), 495–581. WorldCat.org.

Whittington, D., & Grubb, W. N. (1984). Economic Analysis in Regulatory Decisions: The Implications of Executive Order 12291. *Science, Technology, & Human Values*, *9*(1), 63–71. WorldCat.org.