NBER WORKING PAPER SERIES

THE ETHICS OF POLLUTION PRICING

Garth Heutel
J. Paul Kelleher

Working Paper 33300
http://www.nber.org/papers/w33300

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2024

This paper is written as a commission for publication in the Review of Environmental Economics and Policy. We thank the editor, Spencer Banzhaf, and anonymous referees, as well as seminar participants at Georgia State University's Philosophy, Politics, and Economics program and participants at the PPE Society annual conference in New Orleans. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

The Ethics of Pollution Pricing
Garth Heutel and J. Paul Kelleher
NBER Working Paper No. 33300
December 2024
JEL No. H23, Q50, Q52, Q58

ABSTRACT

We survey various ethical issues related to the use of pollution pricing. While pollution pricing, for example in the form of Pigouvian taxes or cap-and-trade systems, is widely used in environmental economics modeling, many moral and ethical assumptions lie behind those models, and many ethical objections to pollution pricing are disregarded. We hope this review will be helpful to environmental economists who are regularly engaged in the use of such models, and in economic reasoning more generally, but who are less familiar with their ethical underpinnings and possible implications.

Garth Heutel
Department of Economics
Andrew Young School of Policy Studies
Georgia State University
Atlanta, GA 30303
and NBER
gheutel@gsu.edu

J. Paul Kelleher
University of Wisconsin–Madison
paul.kelleher@wisc.edu

The Ethics of Pollution Pricing[1]

Garth Heutel, Department of Economics, Georgia State University and NBER

J. Paul Kelleher, Department of Medical History and Bioethics, Department of Philosophy, University of Wisconsin–Madison

December 2024

Abstract

We survey various ethical issues related to the use of pollution pricing. While pollution pricing, for example in the form of Pigouvian taxes or cap-and-trade systems, is widely used in environmental economics modeling, many moral and ethical assumptions lie behind those models, and many ethical objections to pollution pricing are disregarded. We hope this review will be helpful to environmental economists who are regularly engaged in the use of such models, and in economic reasoning more generally, but who are less familiar with their ethical underpinnings and possible implications.

I. Introduction

Perhaps the most universally agreed-upon policy prescription from environmental economists is the recommendation to put a price on pollution to address its market failure. Such a price could be enacted through a Pigouvian tax or a cap-and-trade system. According to the

[1] This paper is written as a commission for publication in the *Review of Environmental Economics and Policy*. We thank the editor, Spencer Banzhaf, and anonymous referees, as well as seminar participants at Georgia State University's Philosophy, Politics, and Economics program and participants at the PPE Society annual conference in New Orleans.

standard narrative, the market failure will be eliminated and pollution levels will be economically efficient—some say "optimal"—when the pollution price equals the marginal external damages from pollution. Moreover, such a price will incentivize cost-effective ways of achieving desired pollution levels. Of course, if there are other market failures besides pollution—e.g. knowledge spillovers or market power—then a price on pollution alone will not necessarily yield an efficient outcome. But setting those possibilities aside, the foregoing claims about pollution pricing are standard fare in environmental economics. Theory is being translated into practice as well; for example, the OECD estimates that in 2021 over 40% of global greenhouse gas emissions were covered by carbon pricing (OECD 2022).

The purpose of this paper is to examine several versions and aspects of this standard narrative from a different perspective: that of moral philosophy and environmental ethics. The paper is co-authored by an environmental economist and a moral philosopher who specializes in environmental economics. We situate our discussion under two broad headings. The first heading concerns *pollution pricing as a tool for policy choice*. Here we examine the normative assumptions and potential normative omissions that characterize several welfare economic frameworks that have been used in environmental economics policy analysis to compute "optimal" pollution prices. Each of these frameworks has been criticized by ethicists as problematically "economistic" in virtue of embracing one or both of the following two propositions: that pollution prices should be optimal prices in the sense that they balance benefits and costs when permitting the substitution of environmental quality by private consumption goods; and that costs and benefits should be valued using techniques that give pride of place to market norms and concepts, like those of consumer sovereignty, revealed preference, and willingness to pay.

The second broad part of our discussion falls under the heading of *pollution pricing as target enforcement*, i.e. policy enforcement.[2] Even when a desirable level of environmental quality and pollution has been identified—for example, by choosing a target like a 2 degree increase over preindustrial temperatures—ethicists have criticized pollution taxes and cap and trade systems on several grounds. One is that any pollution pricing at all reinvites a problematic optimizing approach to environmental policy. A second is that pollution pricing gives the wrong message, by treating what should be a denunciatory fine with an ethically nonjudgmental fee. A third is that when people's polluting behavior responds to price incentives, this can crowd out other intrinsic ethical motivations that are important drivers of environmental and other socially desirable policy measures. We discuss these and other ethical qualms of pollution pricing as form of target enforcement.

Our purpose is to discuss the ethics of pollution pricing and how ethical considerations may impact the design and economic analysis of environmental policy. We wish to introduce some relevant aspects of the fields of moral philosophy and environmental ethics to environmental economists who may be unfamiliar with them. We will consider both climate policies and policies for other pollutants, and we will consider both pollution taxes and cap-and-trade systems. We therefore see our contribution as a valuable complement to papers like Caney and Hepburn (2011), Aldred (2012), Mintz-Woo (2022), or Mintz-Woo (2024), which focus primarily on emissions trading or climate policy. We present this paper in the same spirit of Hausman, McPherson, and Satz (2016)—as a guide to help economists understand how moral philosophy can help them do economics better.

[2] This distinction between these two broad topics echoes the distinction Goodin (1994) draws between *policy choice* and *policy enforcement*.

The paper is structured as follows. The following two sections are concerned with pollution pricing as a tool for identifying desirable public policies. In Section II, we go back to the foundations of welfare economics and discuss five frameworks that have been invoked to support claims about "optimal" pollution levels and "optimal" pollution prices that are commonly used by economists, especially when conducting normative analyses, cost-benefit analyses, or integrated assessment modeling. Then in section III, we consider alternative non-welfarist frameworks for reasoning about ethically responsible environmental policy that are in some tension with the standard economic idea of balancing benefits and costs and also with the commitment in economics to consumer sovereignty and revealed preference. These alternative frameworks are less-commonly used by mainstream and environmental economists, though they feature prominently in discussion among ethicists and moral philosophers. In section IV we move to the topic of pollution pricing as target enforcement. We focus on ethical objections including those concerning improper commodification, civic responsibility, and the crowding out of ethical motivations. Section V concludes.

Some environmental economists may argue that they need not concern themselves with ethics. According to this argument, the work that economists do, including applied welfare economics like cost-benefit analysis, is value-free and independent of any ethical assumptions. Leave it to the philosophers, the politicians, and the democratic populace to handle moral questions. The philosopher of economics Julian Reiss has gone so far as to claim that the field of economics since the middle of the 20th century has been positively "hostile to philosophical reflection" (2013, 1). Like Hausman, McPherson, and Satz (2016) and Berman (2022), we believe that the strict separation of economics and ethics in public policy analysis cannot be maintained. We hope that after reading our paper, environmental economists will agree on the

importance of acknowledging and confronting the ethical issues that are often inherent in their work.

Our purpose is not to prove that environmental economists are doing something "wrong," or that all the ethical issues that we bring up need to be considered in all normative analyses. Rather, we hope to improve the field of environmental economics and guide environmental economists in examining the often implicit ethical assumptions being made in much of their work. Just as in economics more broadly, examining these assumptions will enrich the work being done and potentially lead to the discovery of new questions to be asked and new answers to be found.

II. Back to the Foundations of Welfare Economics

We discuss five distinct bases for claims about "optimal" levels of pollution and about related claims about "optimal pollution prices." In common parlance, "optimal" roughly means "best." When used in environmental and other welfare economics, it typically means either "best according to a given objective function" or "(Pareto) efficient." Because we are concerned with conceptual foundations, our discussion will not delve into mathematical formalism, nor will we examine complications that arise in settings of risk and uncertainty.

Pollution pricing often has a dual meaning, or does double duty, in environmental economics, corresponding to both optimal pricing and policy enforcement. When a pollution tax is set to equal marginal external damages, i.e. at the Pigouvian level, this is often called the "optimal" pollution tax yielding the "optimal" level of pollution; this is a claim about optimal pricing. But for whatever pollution target may be set, it is often argued that the best way to achieve it is through a pollution tax; this is a claim about policy enforcement. The claim about

optimal pricing is sometimes referred to as a pollution tax being "efficient," while the claim about policy enforcement is sometimes referred to as a pollution tax being "cost-effective."[3] This section and the next will together discuss five distinct foundational bases for "optimal" or efficiency-enhancing pricing (which are summarized in Table 1), while section IV will discuss issues related to policy enforcement.

II.a. First framework: Pareto Efficiency (General Formulation)

An outcome is Pareto efficient when there is no feasible move to a different outcome that makes at least one person better off without making anyone else worse off. Typically when Pareto efficiency is at issue in economics, the notions of "better off" and "worse off" are tied to individuals' actual preferences, as opposed to some conception of their "idealized" preferences or—straying farther from the key notion of preference—to a paternalistic conception of what is objectively in their interest. In this paper we adopt this "actual-preference" definition of Pareto efficiency.

In a first-best general equilibrium setting in which pollution is the only market failure, each of a potential continuum of Pareto efficient allocations can be supported with (1) a per-unit tax on each form of pollution, (2) a schedule for redistributing the tax revenue, and (3) a set of lump-sum transfers that establish baseline endowments. These taxes are commonly referred to *Pigouvian taxes*, in honor of A.C. Pigou's trailblazing discussion of them (Pigou 1932, 183ff.).[4]

[3] For example, Tietenberg and Lewis (2018) refer to the "first equimarginal principle" defining when a pollution price yields efficiency and the "second equimarginal principle" defining when a pollution price yields cost-effectiveness.

[4] Though see Banzhaf (2020) or Banzhaf (2023, Ch. 6) for a historical argument in which what we call Pigouvian pollution taxes arise from a tradition distinct from Pigou's work.

Different Pareto efficient allocations may well call for different distribution schedules and different lump-sum transfers, and perhaps even different tax levels depending on the nature and extent of the pollution externality. This result is an extension of the second fundamental theorem of welfare economics, and one important implication is that no Pigouvian tax can be called "the" optimal tax under the criterion of Pareto efficiency alone, unless one has independent reason to treat one particular Pareto efficient allocation as "the" optimal allocation. For this reason, we follow Arrow and Hahn (1983, 91) in referring to "Pareto efficient" allocations and taxes, rather than "Pareto optimal" ones.

If the second welfare theorem's conditions hold and if individuals' utility functions are concave, then every Pareto efficient allocation can be represented as the solution to a weighted sum of individuals' utilities (Mas-Colell, Whinston, and Green 1995, 559–60). Sometimes economists interpret this result as licensing talk of "weighted utilitarianism." However, this result requires *neither* that individual utilities be cardinally measurable *nor* that they are interpersonally comparable. One can thus apply any arbitrary increasing transformation to any individual's utility function and it will still be possible to represent every Pareto efficient allocation as the solution to a weighted "utilitarian" sum. We here place "utilitarian" in quotation marks because any *genuine* utilitarian sum—any summing that is used to evaluate an outcome's desirability vis-à-vis all others'—requires cardinal and interpersonally comparable indices of individuals' conditions (Weymark 2016). Since general equilibrium welfare economics does not require these stronger assumptions, the basis for "optimal" pollution taxation found in the concept of Pareto efficiency is distinct from any that might be found in the philosophical framework of utilitarianism (to which we turn shortly).

In a first-best dynamic general equilibrium setting, each Pareto efficient allocation is an *intertemporal* allocation, and each will be associated with a set of Pigouvian taxes—one for each type of pollution—that equal the present value of the sum of each affected individual's marginal willingness to pay (WTP) for pollution abatement at the efficient equilibrium (Hammond 1998). These present values are computed by discounting WTPs using the efficient allocation's time path of interest rates as discount rates. Pareto efficient interest rates, in turn, will equal each individual's personal consumption discount rate. (Indeed, this is *why* the efficient interest rates are what they are.)

II.b. Second framework: Pareto Efficiency (Negishi Formulation)

Though there are generally a continuum of Pareto efficient allocations, some environmental economists focus on a *specific* Pareto efficient allocation when computing "optimal" pollution taxes. In particular, they focus on the efficient allocation that is Pareto-improving with respect to the prevailing Pareto inefficient baseline. We shall call this specific Pareto efficient allocation the *Negishi allocation with respect to initial endowments*. By exploiting the result that all Pareto efficient allocations can be represented as the solution to a weighted sum of utilities, Negishi explained how to find this Negishi allocation (Negishi 1960).[5] The trick is to iteratively vary the objective function's weights until one identifies the objective function whose solution leaves consumers able to afford both their initial bundle and their final

[5] At a Negishi allocation, the monetized value of every individual's final consumption bundle—at Pareto efficient prices—equals the value of their endowment bundle. That is, their initial and final consumption bundles are affordable to them when these are valued at the efficient allocation's prices. In an economy with public goods and externalities, some of these Pareto efficient prices will be anonymous market prices, while others will be imputed personalized willingnesses to pay for nonmarket amenities. These latter are known as *Lindahl prices* (Hammond 1998, 216, 245–47).

bundle at the solution's prices. This solution exhibits no lump-sum transfers and is therefore Pareto-improving with respect to the initial inefficient allocation. The weighted function that the solution maximizes is the initial baseline allocation's *Negishi maximand*, and the weights are that baseline's *Negishi weights* (Manne 1999, 124–28).

The Pigouvian taxes that prevail at the Negishi allocation with respect to initial endowments are the taxes which, if combined with suitable compensating transfers, could bring about a Pareto efficient outcome that is strictly Pareto-improving.[6] William Nordhaus is a prominent environmental economist whose normative analyses have favored the Negishi allocation (Nordhaus 2008, 40; 2013, 1089–1092). In defense of his focus on the Negishi allocation, Nordhaus writes: "When countries weigh their self-interest in international bargains about emissions reductions and burden sharing, they look at the actual gains from bargains, and the returns on these relative to other investments…" (Nordhaus 2008, 175). For Nordhaus, "optimal" pollution taxation is "efficient" taxation, and the relevant efficient allocation is the Pareto-improving Negishi allocation with respect to the prevailing, real-world inefficient baseline.[7]

Nordhaus stresses that the Negishi analysis "does not make any case for the social desirability of the distribution of incomes over space or time of existing conditions" (Nordhaus 2008, 40). But nor does Nordhaus ever recommend the transfers that would be required to decentralize the Negishi allocation that he declares "optimal". He recommends only what he

[6] Here we invoke an important theoretical distinction between a lump-sum transfer and a *compensating* transfer. The latter may need to be combined with a Pigouvian tax to ensure that the tax does not have the distributive effects associated with lump-sum transfers. See Kelleher (2025, sec. 3.10).

[7] The assumptions embedded into Nordhaus's models ensure that there is a unique Negishi allocation for each inefficient baseline.

calls the "optimal abatement strategy"—i.e. the strategy required to achieve the Negishi allocation's *emissions levels* (Nordhaus 2008, 179). Yet without the transfers, the resulting Pareto efficient allocation will not be the intertemporally Pareto-improving Negishi allocation that his analysis privileges; at best it will be some other Pareto efficient allocation whose normative status is unclear. Perhaps the reply will be that it is up to policymakers to engineer the required transfers. But likewise, it would seem to be up to economists to explain exactly how—and why—the concept of a Pareto-improving outcome lies at the heart of the analysis. After all, the bald concept of (Pareto) efficiency does not privilege any specific efficient allocation, and Pareto-improving outcomes can still be ethically problematic owing (for example) to their distributive profiles.

II. c. Third framework: Potential Pareto Efficiency (Kaldor-Hicks formulation)

Sometimes an analysis in environmental economics is concerned to evaluate small moves away from an inefficient baseline, rather than to identify one or more efficient allocations and their associated pollution taxes. The standard approach to this task is to weigh monetized benefits against monetized costs, with the monetization performed by estimating winners' and losers' compensating variations in the post-policy outcome. These compensating variations are individuals' willingnesses-to-pay for the policy, with winners' willingnesses being positive and losers' being negative. A marginal project or policy is then deemed socially desirable if the winners' aggregate willingness-to-pay is larger than the losers' aggregate. The normative criterion underlying this judgment is the so-called *compensation principle*, which holds that a project is a good thing if the winners could in principle fully compensate the losers and still be better off than they were in the pre-policy baseline (Boadway and Bruce 1984, 96–102). When

this is the case, the policy is said to promote Kaldor-Hicks efficiency, which is named after Nicholas Kaldor and John Hicks who first introduced compensation principles into the welfare economics literature (Kaldor 1939; Hicks 1939).[8]

To our knowledge no moral philosopher has ever embraced the Kaldor-Hicks compensation principle. Not only does it face "severe" problems of internal validity, as the IPCC puts it in its Fifth Assessment Report (Kolstad et al. 2014, 223; see also Broome 2024), but it entails the very implausible normative proposition that a change can be socially desirable when it makes the very best off members of society better off at the expense of the very worst off members, so long as full compensation is merely *possible* (Sen 2000, 947).[9]

Before moving on to welfare frameworks not based on Pareto concepts, we note that many moral philosophers criticize these first three Pareto-based welfare economic frameworks because of the priority they give to the concepts of revealed preference and consumer sovereignty. For example, Elizabeth Anderson claims that by tying the idea of optimal policy to the weighing of costs and benefits expressed in terms of actual willingness-to-pay, economic analysis "assumes that the preferences people express in private consumer choices should be normative for public choice"; when policy justification privileges private consumer wishes, the social protection of "higher goods" like environmental quality is warranted only when they "serve the same function of indiscriminate want-satisfaction that the market is supposed to serve" (Anderson 1995, 194; see also D. Hausman, McPherson, and Satz 2016, 158).

[8] See Suzumura (2011) for an overview and historical perspective.

[9] By contrast, there are many studies in environmental and climate economics that actually *do* model the implementation of compensation payments (e.g. Harrison et al. (2002)).

It is not surprising that philosophers are keen to identify and examine the substantive reasons, values, and principles that underlie individuals' preferences. Many philosophers believe that it is possible to have edifying and constructive arguments concerning matters that some economists may associate with mere "taste." By making individual willingness-to-pay "normative for policy analysis" (to adapt Anderson's phrase), these first three welfare economic frameworks ignore intellectual resources that moral philosophers study and value.[10] These frameworks' sole reliance on consumer-type preferences and valuations, even for non-market goods, was called into question even by early environmental economists (e.g. Eckstein (1961), Dorfman (1997)).[11]

II.d. Fourth framework: Philosophical Utilitarianism

In this and the following subsection, we move away from normative frameworks based on the Pareto concepts in order to discuss two frameworks based on *social welfare functions*. We have already mentioned that the objective functions that Pareto efficient allocations maximize in a general equilibrium framework may be different in kind from the objective functions employed by a philosophical brand of utilitarianism. The former can be used only as reference devices—functions that refer to Pareto efficient allocations. In contrast, the functions that arise within philosophical utilitarianism are bona fide social welfare functions (Weymark 2016). Social welfare functions do not merely characterize or refer to a single allocation, but instead place all

[10] Kallis, Gómez-Baggethun, and Zografos (2013) examine objections to the monetization of nature from the perspective of ecological economics. Vatn (2000) also discusses ecological economics and commodification.

[11] Their arguments for a more socially-based rather than individually-centered normative framework is reminiscent of Amartya Sen's endorsement of "public reasoning" (Sen 2009).

feasible allocations into a ranked ordering. To do this, they must be defined on cardinal and interpersonally comparable *well-being functions* (Adler 2019, 51). The standard assumption within economics is that utility functions—functions that numerically represent consumers' preferences—are not suited for utilitarian analysis, since they are either purely ordinal or non-comparable, or both. Further, moral philosophers commonly hold that an individual's well-being can diverge from her preferences, for it is possible to prefer that which is in fact deleterious to one's well-being. This is another reason why the utility functions used in general equilibrium frameworks may differ from the well-being functions used in normative social choice frameworks based on philosophical utilitarianism.[12]

Assuming that an evaluator possesses a set of cardinal and comparable individual well-being functions, a utilitarian analysis ranks allocations from better to worse by computing the sum of well-beings in each allocation and then ranking allocations by these sums. Since utilitarianism is partly defined by a commitment to impartiality, generally individuals' well-beings are not weighted before they are added together (Broome 2012, 148–153). Mathematically it is possible to articulate weighted versions of philosophical utilitarianism, and views in that camp have been defended by some economists, especially in the form of time-discounted utilitarianism in the context of an infinite time–horizon (e.g. Dasgupta 2005). It is

[12] There is, of course, nothing to prohibit general equilibrium economists from using cardinal and comparable utility functions. But many of the central questions of general equilibrium theory can be studied without those further theoretical commitments. Likewise, some welfarists maintain that well-being is identical to preference-satisfaction, so they are happy to treat cardinal utility functions as well-being functions, provided that comparability can be assured or assumed. An established literature offers guidance on how this might be done, for instance via an equivalent-income measure of well-being; see e.g. Fleurbaey (2016) and Adler and Decancq (2022). Other utilitarians, however, wish to sharply distinguish the ideas of well-being and preference satisfaction, and therefore wish to define social welfare orderings on vectors of well-being functions that may be to some degree paternalistic. For example, Bergstrom (2006) discusses how altruistic and benevolent preferences can be accommodated in cost-benefit analysis based on preferences.

crucial, however, to distinguish a weighted utilitarianism that uses cardinal and interpersonally comparable well-beings in the service of ranking allocations in a social choice framework from a mathematically isomorphic weighted utilitarianism that uses non-comparable utility functions and that arises within a general equilibrium framework concerned, for example, with the task of computing a Pareto efficient allocation and its associated Pigouvian pollution taxes. These are two radically different analytical frameworks, despite any mathematical similarities.

Yet when such mathematical similarities do obtain, the same mathematical tools may be used in both social choice and general equilibrium environmental economics. For example, when objective functions have the familiar discounted utilitarian form, optimal interest rates in either analytical framework will be given by the so-called Ramsey rule, which states that the interest rate in an allocation that maximizes a discounted utilitarian objective function equals the rate of pure time preference plus the product of the growth rate in per capita consumption and a parameter reflecting the curvature of individuals' utility or well-being functions. Note that different curvature parameters may be called for by different analytical frameworks, and that the same is true for the rate of pure time preference. For example, a general equilibrium framework may rightly use individuals' actual, revealed rates of pure time preference, whereas a philosophical social choice framework may correctly use a lower, normative rate of pure time preference (Kelleher 2025).[13]

In the general equilibrium framework, optimal pollution taxes are those that can support a given Pareto efficient allocation in a decentralized fashion. In contrast, we have already seen that philosophical utilitarianism may not give Pareto efficiency the same foundational importance.

[13] Kelleher suggests that the Stern-Nordhaus "debate" was largely predicated upon a failure to distinguish between these two distinct analytical frameworks.

Since some utilitarian frameworks employ "paternalistic" well-being functions, for example, the allocations that maximize utilitarian social welfare functions may not be Pareto efficient, since Pareto efficiency is defined relative to preferences (Broome 1991, chap. 7).[14] It may therefore not be possible to fully decentralize the allocation that maximizes a utilitarian social welfare function, based on the second fundamental theorem. For these reasons, the rationale for pursuing a second-best environmental economics can differ depending on which analytical framework one works within.

II.e. Fifth framework: Prioritarianism

An important rival to utilitarianism shares its welfarism while rejecting its insensitivity to the distribution of well-being. Like utilitarianism, *prioritarianism* is welfarist because it ranks allocations exclusively based on people's well-being in different outcomes. But unlike utilitarianism, prioritarianism respects a *Pigou-Dalton principle*, which favors allocations that are more equal. Specifically, Pigou-Dalton always classifies a transfer of a unit of well-being from a better off person to a worse off person as a good thing (so long as the better off person remains better off after the transfer than the worse off person was before the transfer).

It is possible to formalize prioritarian frameworks as combining an objective concerned with total well-being with a separate distributive objective to reduce inequalities of well-being. Yet some defenders of prioritarianism dislike this characterization, preferring to present the view not as balancing well-being and equity, but rather as a view simply concerned to promote

[14] As we noted at the beginning of section II.a., we are following the trend in economics of defining Pareto efficiency in terms of actual preferences. It is possible, however, to formulate counterpart Paretian concepts of principles that are articulated in terms of the concept of (potentially paternalistic) well-being. Indeed, such principles play a key role in the axiomatic analysis of welfarist social welfare functions. See Adler (2019, sect. 3.2) for an overview.

individuals' interests in a way that displays a proper attitude of fairness toward all (Adler 2012, 199ff.). Either way, stronger and weaker versions of prioritarianism can be characterized by the degree to which they tolerate "leaky" transfers from better off to worse off individuals. (A transfer is leaky if the "donor"—i.e. the better off person—loses more well-being than the recipient receives.) What economists sometimes call a *Rawlsian social welfare function* is an example of a maximally leak-tolerant prioritarian view: *any* degree of leakage is tolerated so long as it increases the well-being of the worst-off member(s) of society.[15] Despite this connection with Rawlsian ideas, the standard prioritarian approach is welfarist rather than deontological, and decidedly monistic (maximizing a social welfare function) rather than pluralistic (combining well-being with some other aim concerned with justice, rights, and so on).[16]

Like utilitarians, prioritarians must decide whether and how far to depart from a fully preference-satisfaction–based conception of well-being. Most prioritarians reject a fully preference-satisfaction based view, preferring at least to privilege "informed" or "idealized" preferences over actual preferences, which are likely to reflect imperfect information and cognitive biases (Adler 2019, 48–50). For this reason and other reasons, prioritarian "optimal" pollution taxes, like those from some forms of utilitarianism, may not be able to play the decentralizing role that Pareto efficient taxes play in a first-best general equilibrium setting (Fleurbaey 2010, 669).

[15] See Hirose (2014). Rawls was not himself a proponent of this view. For alternative social welfare functions concerned with distributional outcomes in applied cost-benefit analyses, see Adler (2016); Fleurbaey and Abi-Rafeh (2016); Robinson, Hammitt, and J. Zeckhauser (2016), and see Banzhaf (2023a) for a historical discussion of distributional concerns in policymaking.

[16] Parfit (1995) usefully distinguishes prioritarianism from egalitarianism, which recognizes an intrinsic value of equality.

Neither utilitarianism nor prioritarianism centers the economic concepts of consumer sovereignty and revealed preference. As we have noted, each can coherently employ a "paternalistic" conception of individuals' well-being. This is a major difference between these philosophical frameworks and the three preceding economic frameworks.[17] But like those three economic frameworks, utilitarianism and prioritarianism do center the concept of optimality: policy maximally increases social welfare when the marginal benefits of further policy action exactly equal its marginal costs. This concept of optimality brings with it potential ethical issues.

In these welfarist frameworks, for instance, environmental goods are "indifferently substitutable" with private consumption (to use Anderson's disparaging phrase). Of course, the elasticity of substitution in well-being between these amenities will vary depending on the respective *levels* of environmental goods and private consumption. But there will be *some* elasticity, from which it follows that environmental despoilation will in principle be "fully compensable" through money payments.[18] That is, environmental goods and private market goods (and indeed all types of goods) are *commensurable* with each other. This implication is criticized by Anderson (and others), who likens it to a standing openness to eat one's pet, or to make it available for use in laboratory experiments, so long as the meat is tasty enough or the experimenter's bid price high enough (1995, 208). The concern here is an unlimited commensurability between ordinary private consumer goods and other potentially "higher" goods, like environmental quality. Many have argued that these goods are in fact incommensurable with each other. The philosophical literature on incommensurability is vast and

[17] For instance, Del Campo, Anthoff, and Kornek (2024) discuss ways in which studies have attempted to measure individual or social preferences for inequality aversion in the context of climate policy.

[18] The monetary valuation of nature and environmental goods, and their resulting commensurability with market goods, dates back at least to Krutilla (1967), which even incorporated non-use or existence values.

we are unable to do it full justice here,[19] though we will return to the topic in the context of policy enforcement below. The important point for now is that ethicists know that trade-offs are necessary but often argue that policy trade-offs should favor what they deem "higher goods", which can include things like rights and justice.[20] We discuss these concepts further in the next section.

III. Deontological Approaches

The previous section described frameworks of policy choice that are either commonly used by environmental and other welfare economists (like the frameworks built upon the notion of Pareto efficiency) or are closely related to them. Each of those frameworks is hospitable to the concept of optimality, since each approves of incremental changes until the marginal social costs of a further change exactly equals its marginal social benefit. We now turn to evaluative frameworks that are less hospitable to this brand of quantitative cost-benefit reasoning, and thus less commonly used in environmental welfare economics. These are *deontological* frameworks.

Within moral and political philosophy, *deontology* is the view that ethical principles can impose hard constraints against the single-minded promotion of a welfarist goal. It commonly holds that there are multiple distinct yet equally valid ethical principles. The term "deontology" stems from the Greek for "duty", and the term is chosen because deontologists typically recognize a plurality of duties, each of which arises in virtue of a distinctive normative consideration (Ross 1930). Of the five welfare economics frameworks we set out in section II,

[19] A classic article is Raz (1985).

[20] An attempt to incorporate the incommensurability of multiple objectives, including the valuation of environmental goods and natural resources, in something like a cost-benefit analysis framework was undertaken by members of the Harvard Water Program in the 1950s-60s; see Banzhaf (2023, Ch. 8).

the Negishi approach is arguably the most deontological, for it seeks to identify Pareto efficient policies that could be agreed to by individuals who jointly seek to address pollution in a manner all can accept as in their interest (i.e. policies that are Pareto improvements relative to the status quo baseline). This view combines a putatively worthy goal (Pareto efficiency) with the view that the goal should be pursued only in ways that are acceptable to every affected individual.

Deontology raises difficult questions for environmental policy, especially pollution pricing policy. As Matt Zwolinski notes, a serious weakness of the most staunchly deontological political philosophy, libertarianism, is not that it is not sensitive to environmental issues, "but that it is *too sensitive by far*" (Zwolinski 2014, 9).[21] An externality like pollution is, after all, an unwanted and potentially harmful intrusion into another's body or property. Deontological libertarians might argue that this is always unjustified without the consent of those at risk of harm. And yet most deontologists would classify the "demand that we eliminate pollution altogether" as a "grossly implausible goal" (Zwolinski 2014, 12). Robert Nozick, a staunch deontological libertarian, was aware of the problems of a deontological approach in the case of pollution (Nozick 1974, 79–81).

This dilemma appears resolvable only by re-invoking the moral relevance of good consequences, and by requiring that a portfolio of independently compelling individual rights must itself pass a sort of cost-benefit test that weighs that portfolio against the aggregate welfare costs of fully respecting it. Onto the scales of this cost-benefit analysis many deontologists

[21] Sometimes libertarianism is defended on non-deontological grounds, including on welfare consequentialist grounds. See Thrasher (2017, 217–19) for a useful discussion. Here we focus exclusively on the more common deontological versions. The implications of Coaseian bargaining (Coase 1960) can be analogous to those coming from some deontological libertarian theories, though Coase's justification was based in Pareto efficiency.

would wish to add non-anthropocentric considerations concerning the value of non-human animals, ecosystems, and other features of the natural world.

No deontologist has offered such a comprehensive cost-benefit analysis of rights, and it is hard to see how such a thing could be constructed in a compelling way. Any but the most radical cost-benefit analyses require some commitment to commensurability between different goods, and a "comprehensive" cost-benefit requires the commensurability of radically different goods and of radically different normative considerations. Anderson maintains that we have reasons to "valu[e] environmental goods intrinsically" and as "worthy of our appreciation" (Anderson 1995, 206–7). This contrasts with a view on which nature has value only when and because human beings happen to care about it. As we have already seen, Anderson believes we should value some goods in "higher ways," which entails that we should regard them "as not having a price"—that is, as not "indifferently substitutable" for some alternative bundle of commodities (Anderson 1995, 208). This reflects an ethics that embraces *value pluralism*—the belief that there are different types of values that cannot all be reduced to a common metric—as opposed to *value monism*, which is implied by any framework that calculates an all-things-considered optimal pollution price based on a standard cost-benefit analysis.[22]

Value pluralism does not entail that we must forbid all trade-offs between environmental goods and other contributors to human well-being like market goods. Instead it means identifying real opportunities to give expression to environmental goods' higher value:

> One point of protecting natural goods of special aesthetic or ecological significance is to open up opportunities for us to engage with nature on harmonious, non-exploitative terms.

[22] Value pluralism is a major tenet in much of ecological economics (see e.g. Gowdy and Erickson 2005). The philosopher Johanna Thoma (2023) has recently argued for an increased use of value pluralism across social sciences.

> To fully express the higher modes of valuation implicated in such engagement, we must set aside some natural enclaves that are fully protected from encroachment by exploitative attitudes…This means that, contrary to the market norm upheld by cost-benefit analysis, we should not be indifferent between preserving higher environmental goods and acquiring any bundle of commodities with the "same" cash value. (Anderson 1995, 208)

The argument here is that deontologically acceptable institutions must find ways to examine and evaluate environmentalist principles, reasoning, and arguments, rather than appraising policies solely by aggregating well-being or individuals' "dollar votes". Anderson and other deontologists readily acknowledge that no precise recipe exists for how to do this, and that some well-meaning "experiments in living" will seem misguided after they are tried (Anderson 2014; see also Schmidtz 2023).

IV. Objections to Price Instruments

We now turn from the topic of pollution pricing in the context of policy choice to the topic of pollution pricing as target-enforcement. The central question is this: what objections to pricing pollution remain once a policy target—for example, keeping pollution levels below some "safe" level—is identified, regardless of how that target level was chosen? As we will see, many relevant issues are closely related to those we discussed in the previous two sections.

In a seminal paper in which he likens both pollution taxes and priced emissions allowances to medieval religious indulgences, Robert E. Goodin describes pollution prices as a sort of economic "fallback position", since they can be endorsed on economic grounds even if the "the more attractive…economistic faith" in optimal pollution pricing is rejected (Goodin 1994, 589). The economic rationale for target-enforcing pollution pricing is cost-effectiveness:

under a uniform pollution price, abatement measures will be undertaken in order of their expense, minimizing overall costs. Goodin characterizes target-enforcing pollution pricing as a "retreat" from economists' "strongest claims on behalf of green taxes," which invoke the welfare economic frameworks we have already canvassed and which can be read as deeming a certain level of environmental despoilation as "not merely all right, but actually right—socially optimal" (Goodin 1994, 591). Merely target-enforcing pricing, by contrast, is consistent with the view that despoiling the environment is never "actually right", but that pollution can nevertheless be permissible ("merely all right") given the difficult trade-offs that societies face among the many competing ethical considerations policymakers must respond to.

We identify several objections in this section, summarized in Table 2. First, there are ethical concerns with *commodification*—the fact that pricing pollution may inappropriately commodify or monetize the environment. Second, some object that pollution pricing undermines the moral imperative of *civic responsibility* or collective sacrifice required of all citizens to protect the environment. Third, (and as we discussed earlier) pollution pricing may be said to ignore the fact that some goods are *incommensurable,* and therefore it may be attempting to "price the priceless." Fourth, we discuss whether pollution pricing may *crowd out intrinsic moral motives*. Fifth and finally, we compare different ways of pricing pollution—most importantly, comparing a cap-and-trade system with a pollution tax, but also looking at abatement subsidies and looking at the use of any revenues and the ethical implications of these issues.

IV.a. Commodification

In a way, putting a price on pollution treats clean air or water, or the natural environment more generally, as a market good. Many thinkers classify this as morally problematic commodification. Objections in this vein follow in the long tradition of views that concern the "moral limits of markets" and that maintain that some things should not be for sale. Satz (2010) for example argues that buying and selling certain things amounts to creating a "noxious markets." She cites, for example, markets in child labor. [23]

The monetization of natural resources implicit in pollution pricing leads to a series of potential moral qualms. Buller (2022) criticizes what she calls "green capitalism," which includes commodification through pollution pricing as well as the dominance of economic thinking in environmental policy design (an argument echoed in Berman (2022)). Page (2012) expands on this, arguing that the influence of commodification on normative ideals has been neglected. The two ideals that he focuses on are political legitimacy and procedural justice. Both goals, he argues, are imperiled by the use of pollution pricing (carbon cap-and-trade markets in particular) due to the sole focus of policymakers on economic efficiency and environmental effectiveness.

Caney and Hepburn (2011)consider and reject the claim that cap and trade systems are ethically objectionable because the very idea of private property rights in the natural world is ethically objectionable. Caney and Hepburn reply that well-designed cap and trade regimes can involve the granting of only "use rights" in nature, as opposed to private *property* rights. They

[23] According to her argument, four characteristics that can make a market noxious are having extremely harmful outcomes to individuals, having extremely harmful outcomes for society, featuring weak agency or highly asymmetric knowledge, and reflecting underlying vulnerabilities. Two argument types are common here. First there are so-called "essentialist" arguments on which some good or other is, by its very nature, not properly bought and sold. Second there are non-essentialist arguments that are principally concerned with a given market's bad effects.

argue that a permit to emit a unit of pollution might be granted as a type of use right by the global community, and not as the transfer of a property right from that community to a given individual or firm.

In response, Aldred presses neither the essentialist objection that it is inherently ethically wrong to grant use rights in nature nor that it is always intrinsically ethically wrong to emit harmful pollution. Instead, his main "commodification"-based objection is that "attaching a price sets up a rival account of value. … In order to protect what has value, the market makes contextual judgements about relative value." (Aldred 2012, 346) Thus his claim is that by adopting pollution pricing as a target enforcement mechanism, one inevitably (re)introduces an ethically objectionable approach to policy *choice*—namely, an approach that lets people's preferences over market goods determine how much pollution is emitted.

One issue that, to our knowledge, has not been investigated is the possibility that some forms of pollution pricing may (unethically) commodify while others may not. For example, perhaps a pollution tax does commodify the environment, whereas a cap-and-trade system does not (or vice versa). It may seem as if this could not possibly be so, since both mechanisms work simply by making pollution more expensive to emit. But as we will see below in the context of the "crowding out" objection, different mechanisms—or the same mechanism in different contexts—could have different effects that are ethically relevant. Whether these differences could sustain a commodification-based objection for one mechanism but not the other is a topic we hope others might explore in future research.

IV.b. Collective Responsibility

Allowing polluters to pollute as much as they want so long as they pay a price, via a pollution tax or a cap-and-trade market, strikes some as immoral since it treats something that should be part of one's civic or collective responsibility as something optional. This intuition is analogous to that of objecting to allowing the requirement of mandatory military service to be waived upon providing payment, as was the case for the United States during the Civil War. There may be some services or actions that it is our individual moral or civic responsibility to perform, and we may be required to make some collective sacrifices for the common good. Many argue that the duty to protect the environment, or at least to not contribute to degrading it, falls into such a category of civic responsibility, and that it is unethical to allow this responsibility to be waived by paying a price.

Perhaps the strongest proponent of this view is the moral and political philosopher Michael Sandel, who appeals to the ethical import of a fine/fee distinction: "[f]ines register moral disapproval, whereas fees are simply prices that imply no moral judgment" (Sandel 2012, 65). Indeed, Sandel claims that "the moral problem with a global market in pollution permits is…the outsourcing of an obligation"—for example, by "allowing rich countries to avoid meaningful reductions in their own energy use by buying the right to pollute from others" (75). [24]

What can be said for this collective responsibility argument? *Is it* ethically troubling for rich individuals or nations to evade an environmental obligation by paying a tax or by purchasing a permit? We think the answer turns on the relevant substantive ethical frameworks—welfarist, deontological, etc.—that bear on the upstream policy choice questions, including questions concerning the initial distribution of income, the distribution of burdens from pollution, and the eventual distribution of the pollution tax revenue. Further we believe it is telling that the most

[24] Mintz-Woo (2022) also discusses this argument, calling it the *solidarity* argument.

prominent collective-responsibility arguments—those from Goodin and Sandel—ultimately underscore the effects that the presence of pricing mechanisms may have on the choice of policy targets themselves. This suggests—but certainly does not prove—that as long as environmental policymaking is effective or otherwise just (including distributively just), this is enough to ensure that everyone is adequately fulfilling their civic responsibilities, even if they are doing so via compliance with a policy of pollution pricing.

IV.c. Incommensurability

We have already discussed incommensurability between market goods and environmental goods in our sections on policy choice. Here we briefly note that this issue, and the imposition of value monism rather than value pluralism, also bears relevance to policy enforcement. How so? If policymakers choose a pollution target through some method that does not itself raise insurmountable concerns with incommensurability, does the use of pollution pricing to meet that goal reintroduce objections based on incommensurability? Aldred (2012) argues that it does. While acknowledging that "in principle, a price can be attached to something without entailing that the thing be valued in terms of its price," he argues that for cap-and-trade markets "in reality, attaching a price sets up a rival account of value." He seems to believe that putting a price on pollution is tantamount to imposing, via the implication of social norms, the commensurability of environmental quality with dollars. Others have argued against this claim. Page (2011) argues that moving from a Kantian critique of the incommensurability between money and human lives or human dignity to a claim of incommensurability between money and environmental goods and involves a "set of conceptual leaps" that are undefended.[25]

[25] See also Caney (2010), Dirix, Peeters, and Sterckx (2016), and O'Neill (2017).

IV.d. Crowding Out

If people have intrinsic or altruistic motivations for protecting the environment or for reducing their emissions, then pricing pollution might crowd out these motivations and result in a lower-than-expected reduction in pollution, or even an increase. This concern is motivated by several examples from various contexts; for example, Gneezy and Rustichini (2000) provide a case study where introducing a fine for picking children up late from a childcare center actually increased the prevalence of late pick-ups.[26] Cardenas and co-authors found a similar result in an experimental public bads game involving real money payoffs (Cardenas, Stranlund, and Willis 2000). The possibility of such crowd out in response to pollution pricing is consistent with this evidence of crowd out in these other contexts (Aldred 2012; Bazin, Ballet, and Touahri 2004). Yet at the same time, Cardenas has found evidence of a small fine crowding *in* non-self-interested preferences (but without the magnitude of the fine much affecting the degree of crowd-in) (Cardenas 2004). More research is needed to fully understand these phenomena and their import for pollution pricing policies.[27]

Is the concern over crowding out in the context of policy enforcement an *ethical* concern with pollution pricing, or is it merely a concern about *effectiveness*? In line with a recurring theme in this review, we suggest that it is first and foremost a matter of effectiveness, with the

[26] Titmuss (1970) argues that paying for blood donations rather than having them be voluntary will crowd out the donations and could yield a reduction in total giving. Mellström and Johannesson (2008) provide field experimental evidence supporting this claim. Sandel (1998) cites the results from a survey in Switzerland on nuclear waste siting where citizens reported being less likely to support local siting if they were offered financial incentives: "the prospect of a private payoff transformed a civic question into a pecuniary one" (p. 116). Myriad other examples are found in Bowles (2016).

[27] Further relevant empirical evidence comes from Heller and Vatn (2017), who show that a weight-based fee on household waste had a "divisive" effect on intrinsic motivation to sort waste.

main ethical concern being the degree to which the crowding out social and ethical preferences feeds back into the realm of policy choice. Market arrangements, including the presence of a carbon tax or cap-and-trade system, may crowd out sentiments of social morality or civic-mindedness that are needed to ensure support for and compliance with ethically-responsible social actions. Yet this is of course an empirical question, and here too there is some countervailing evidence; for example, Carattini, Baranzini, and Lalive (2018) find that public support for a garbage tax increased after the garbage tax was passed.

Before one rejects a pollution pricing proposal based on a concern with crowding-out, one should acknowledge that ethical preferences and motivations might also be crowded out by alternative environmental policies. For example, a command-and-control policy, like banning the production of gasoline-powered cars, might crowd out intrinsic motivations to protect the environment. A key difference is that with a command-and-control policy the environmentally-unfriendly action is removed as an option. But crowd out may still matter for how effective the command-and-control policy is; for example, when forced to buy an electric car, a driver might reduce her environmentally-friendly behavior elsewhere. Magnitudes matter, and it is important to determine whether crowding out disproportionately affects pollution pricing relative to other environmental policies.

IV.e. The Form of Pollution Pricing

Generally the philosophical literature has not had much to say about moral differences between pollution taxes and cap and trade regimes. An exception is Mintz-Woo (2022, sect. 3.2), who specifically addresses the ethics of this distinction and who draws on papers by Spash (2010) Gesang (2013), and Tank (2020). Mintz-Woo concludes that price instruments have a

"theoretical edge" over quantity instruments, on the grounds that total emissions or emissions reductions are fixed by a permit system but can be "canceled out" under a tax. We agree that this argument may be important in regards to the collective responsibility objection to pollution pricing, and we more generally suggest that further examination of the potential ethical differences between taxes and caps would be a fruitful line of inquiry for scholars.

One further interesting possibility raised by the phenomena uncovered by Cardenas and colleagues is that different forms of pollution pricing (as well as pricing that is deployed in different contexts) may either crowd-in or crowd-out important social preferences—including preferences for "higher" goods like environmental equality—and that they may do so to different degrees. This in turn might support ethical objections to different pricing mechanisms that cannot be justified fully *a priori*, but which instead depend on contingent and context-sensitive effects. Discussions of pricing mechanisms in moral and political philosophy often elide a priori and empirically inflected concerns, and we suggest that future research both be clearer in distinguishing between them and more focused in exploring where and when context-specific features bear on the ethical evaluation of a given policy instrument.

We know of no studies that investigate the ethics of policies that price pollution through subsidies rather than through taxes or cap-and-trade. From an efficiency perspective (i.e. the neoclassical default lens), subsidies can be equivalent to these other polices if designed properly, although the distributional burdens will differ (Heutel 2014; Phaneuf and Requate 2016, 52–53). Many real-world environmental policies feature subsidies of some sort (for example, the various subsidies in the Inflation Reduction Act of 2022). Many of the same ethical issues are likely to arise with abatement subsidies, including concerns over commodification and an erosion of

collective responsibility. But it remains possible that there are distinct issues related to subsidies, so this is a worthy avenue for future exploration.

None of the ethical studies we cite addresses the use of revenues from pollution pricing systems, or how the choice of revenue recycling can impact the moral assessment of a policy. Revenue recycling is an essential component in the analysis of the efficiency of pollution pricing (Bovenberg and De Mooij 1994) and its distributional effects (West and Williams 2004) (Budolfson et al. 2021). It is conceivable that revenue recycling is also important for the ethical analysis of these systems. While this discussion is outside the scope of our review, we also think that it is an area in which future research would be fruitful.

V. Conclusion

We have reviewed some of the many ethical issues related to pollution pricing as a policy tool with the goal of familiarizing more environmental economists with these issues to inform their approaches to policy analysis. We did not delve into detail about any of these issues but refer the interested reader to many citations for studies that do so. We have highlighted the ethical considerations related to both policy choice—using pollution pricing to solve for optimal policy levels—and to policy enforcement—the use of pollution pricing to achieve an already-agreed-upon policy goal. These two sets of questions are intertwined, and many of the ethical considerations that relate to policy enforcement are also bound up in questions of policy choice.

Environmental economists realize that efficiency is just one goal among many in policy analysis, though efficiency has been prioritized throughout the neoclassical environmental economics literature. A growing number of economists are more carefully studying distributional issues and those related to political feasibility alongside efficiency. But we believe

that certain other ethical issues have been given less consideration and may be underappreciated in economists' real-world policy applications. Many issues related to distributions and political feasibility are intertwined with ethical arguments, but we point out that there are further ethical considerations beyond these. Additionally, even a sole focus on efficiency is shot through with various ethical assumptions. These ethical assumptions can have grave real-world implications; Ando et al. (2024) discuss ways in which environmental economics may unintentionally further systemic racism.

Because we believe it will strengthen economics research, our aim has been to help environmental economists understand better the ethical issues inherent in normative policy analysis. Perhaps ethical considerations can be explicitly incorporated into some neoclassical economic framework. Or, an environmental economist can make a contribution to the moral philosophy literature. In any case, a reckoning with and appreciation of these issues and relationships stands to benefit our understanding of the field.

References

Adler, Matthew. 2020. "What Should We Spend to Save Lives in a Pandemic? A Critique of the Value of Statistical Life." *Covid Economics*, no. 33, 1–45.

Adler, Matthew D. 2012. *Well-Being and Fair Distribution: Beyond Cost-Benefit Analysis*. New York: Oxford University Press.

———. 2016. "Benefit–Cost Analysis and Distributional Weights: An Overview." *Review of Environmental Economics and Policy* 10 (2): 264–85. https://doi.org/10.1093/reep/rew005.

———. 2019. *Measuring Social Welfare*. Oxford University Press.

Adler, Matthew D., and Koen Decancq. 2022. “Well-Being Measurement.” In *Prioritarianism in Practice*. Cambridge: Cambridge University Press. https://repository.uantwerpen.be/docstore/d:irua:5961.

Aldred, Jonathan. 2012. “The Ethics of Emissions Trading.” *New Political Economy* 17 (3): 339–60. https://doi.org/10.1080/13563467.2011.578735.

Anderson, Elizabeth. 1995. *Value in Ethics and Economics*. Harvard University Press.

———. 2014. “Social Movements, Experiments in Living, and Moral Progress: Case Studies from Britain’s Abolition of Slavery.” *Lindley Lecture*.

Ando, Amy W, Titus O Awokuse, Nathan W Chan, Jimena González-Ramírez, Sumeet Gulati, Matthew G Interis, Sarah Jacobson, and Dale T Manning. 2024. “Environmental and Natural Resource Economics and Systemic Racism” *Review of Environmental Economics and Policy* 18 (1): 143–64.

Arrow, Kenneth J., and F. H. Hahn. 1983. *General Competitive Analysis*. Elsevier Science.

Banzhaf, H Spencer. 2020. “A History of Pricing Pollution (or, Why Pigouvian Taxes Are Not Necessarily Pigouvian).” National Bureau of Economic Research.

Banzhaf, H. Spencer. 2023a. “Distribution and Disputation: Net Benefits, Equity, and Public Decision-Making.” *Journal of Benefit-Cost Analysis* 14 (2): 205–29. https://doi.org/10.1017/bca.2023.30.

———. 2023b. *Pricing the Priceless: A History of Environmental Economics*. 1st ed. Cambridge University Press. https://doi.org/10.1017/9781108867184.

Baumol, William J. 1972. “On Taxation and the Control of Externalities.” *The American Economic Review* 62 (3): 307–22.

Baumol, William J, and Wallace E. Oates. 1988. *The Theory of Environmental Policy*. Cambridge University Press.

Bazin, D., J. Ballet, and D. Touahri. 2004. "Environmental Responsibility versus Taxation." *Ecological Economics*, Papers of the Eight Meeting of the International Society for Ecological Economics; Montreal, Ont. Canada; July 11-14, 2004, 49 (2): 129–34. https://doi.org/10.1016/j.ecolecon.2004.03.015.

Bergstrom, Theodore C. 2006. "Benefit-Cost in a Benevolent Society." *American Economic Review* 96 (1): 339–51.

Berman, Elizabeth Popp. 2022. *Thinking like an Economist: How Efficiency Replaced Equality in U.S. Public Policy*. Princeton University Press. https://doi.org/10.2307/j.ctv1vtz8n7.

Boadway, Robin W, and Neil Bruce. 1984. *Welfare Economics*. Oxford: Basi Blackwell.

Bovenberg, A. Lans, and Ruud A. De Mooij. 1994. "Environmental Levies and Distortionary Taxation." *The American Economic Review* 84 (4): 1085–89.

Bowles, Samuel. 2016. *The Moral Economy: Why Good Incentives Are No Substitute for Good Citizens*. Yale University Press.

Broome, John. 1991. *Weighing Goods: Equality, Uncertainty and Time*. Oxford, UK: Basil Blackwell.

———. 2012. *Climate Matters: Ethics in a Warming World (Norton Global Ethics Series)*. WW Norton & Company.

———. 2024. "The Value of Life in the Social Cost of Carbon: A Critique and a Proposal." *Journal of Benefit-Cost Analysis*, September, 1–17. https://doi.org/10.1017/bca.2024.21.

Budolfson, Mark B, David Anthoff, Francis Dennig, Frank Errickson, Kevin Kuruc, Dean Spears, and Navroz K Dubash. 2021. “Utilitarian Benchmarks for Emissions and Pledges Promote Equity, Climate and Development.” *Nature Climate Change* 11 (10): 827–33.

Budolfson, Mark, Francis Dennig, Frank Errickson, Simon Feindt, Maddalena Ferranna, Marc Fleurbaey, David Klenert, Ulrike Kornek, Kevin Kuruc, and Aurélie Méjean. 2021. “Climate Action with Revenue Recycling Has Benefits for Poverty, Inequality and Well-Being.” *Nature Climate Change* 11 (12): 1111–16.

Buller, Adrienne. 2022. *The Value of a Whale: On the Illusions of Green Capitalism*. Manchester University Press.

Caney, Simon. 2010. “Markets, Morality and Climate Change: What, If Anything, Is Wrong with Emissions Trading?” *New Political Economy* 15 (2): 197–224. https://doi.org/10.1080/13563460903586202.

Caney, Simon, and Cameron Hepburn. 2011. “Carbon Trading: Unethical, Unjust and Ineffective?” *Royal Institute of Philosophy Supplement* 69 (October):201–34. https://doi.org/10.1017/S1358246111000282.

Carattini, Stefano, Andrea Baranzini, and Rafael Lalive. 2018. “Is Taxing Waste a Waste of Time? Evidence from a Supreme Court Decision.” *Ecological Economics* 148:131–51.

Cardenas, Juan Camilo, John Stranlund, and Cleve Willis. 2000. “Local Environmental Control and Institutional Crowding-Out.” *World Development* 28 (10): 1719–33.

Cardenas, Juan-Camilo. 2004. “Norms from Outside and from inside: An Experimental Analysis on the Governance of Local Ecosystems.” *Forest Policy and Economics* 6 (3–4): 229–41.

Coase, R. H. 1960. “The Problem of Social Cost.” *The Journal of Law and Economics* 3:1–44. https://doi.org/10.1086/674872.

Dasgupta, P. 2005. “Three Conceptions of Intergenerational Justice.” In *Ramsey’s Legacy*, edited by H. Lillehammer and D. H. Mellor. Oxford: Oxford University Press.

Del Campo, Stellio, David Anthoff, and Ulrike Kornek. 2024. “Inequality Aversion for Climate Policy.” *Review of Environmental Economics and Policy* 18 (1): 96–115. https://doi.org/10.1086/728371.

Dirix, Jo, Wouter Peeters, and Sigrid Sterckx. 2016. “Emissions Trading Ethics.” *Ethics, Policy & Environment* 19 (1): 60–75. https://doi.org/10.1080/21550085.2016.1173282.

Dorfman, Robert. 1997. “Economic Theory and Public Decisions: Selected Essays of Robert Dorfman.” In *Economic Theory and Public Decisions*. Edward Elgar Publishing.

Eckstein, Otto. 1961. “A Survey of the Theory of Public Expenditure Criteria.” In *Public Finances: Needs, Sources, and Utilization*, 439–504. Princeton University Press.

Ferranna, Maddalena, and Marc Fleurbaey. 2022. “Prioritarianism and Climate Change.” In *Prioritarianism in Practice*, edited by Matthew D Adler and Ole F Norheim, 360–407. Cambridge University Press.

Fleurbaey, Marc. 2010. “Assessing Risky Social Situations.” *Journal of Political Economy* 118 (4): 649–80.

———. 2016. “Equivalent Income.” In *The Oxford Handbook of Well-Being and Public Policy*, edited by Matthew D Adler and Marc Fleurbaey, 453–75. Oxford University Press.

Fleurbaey, Marc, and Rossi Abi-Rafeh. 2016. “The Use of Distributional Weights in Benefit–Cost Analysis: Insights from Welfare Economics.” *Review of Environmental Economics and Policy* 10 (2): 286–307. https://doi.org/10.1093/reep/rew003.

Gesang, Bernward. 2013. “What Climate Policy Can a Utilitarian Justify?” *Journal of Agricultural and Environmental Ethics* 26 (2): 377–92. https://doi.org/10.1007/s10806-012-9380-4.

Gneezy, Uri, and Aldo Rustichini. 2000. “A Fine Is a Price.” *The Journal of Legal Studies* 29 (1): 1–17. https://doi.org/10.1086/468061.

Goodin, Robert E. 1994. “Selling Environmental Indulgences.” *Kyklos* 47 (4): 573–96.

Goulder, Lawrence H, and Roberton C Williams III. 2012. “The Choice of Discount Rate for Climate Change Policy Evaluation.” *Climate Change Economics* 3 (04): 1250024.

Gowdy, John, and Jon D. Erickson. 2005. “The Approach of Ecological Economics.” *Cambridge Journal of Economics* 29 (2): 207–22.

Hammond, P. 1998. “The Efficiency Theorems and Market Failure.” *Elements of General Equilibrium Analysis*, 211–60.

Harrison, Glenn W., Jesper Jensen, Morten I. Lau, and Thomas F. Rutherford. 2002. “Policy Reform without Tears.” In *Policy Evaluation with Computable General Equilibrium Models*. Routledge.

Hausman, Daniel M. 1995. “The Impossibility of Interpersonal Utility Comparisons.” *Mind* 104 (415): 473–90.

Hausman, Daniel, Michael McPherson, and Debra Satz. 2016. *Economic Analysis, Moral Philosophy, and Public Policy*. Cambridge University Press.

Heal, Geoffrey. 1991. “Economy and Climate: A Preliminary Framework for Microeconomic Analysis.” In *Commodity and Resource Policies in Agricultural Systems*, 196–212. Springer.

Heller, Marit H., and Arild Vatn. 2017. “The Divisive and Disruptive Effect of a Weight-Based Waste Fee.” *Ecological Economics* 131 (January):275–85. https://doi.org/10.1016/j.ecolecon.2016.09.002.

Heutel, Garth. 2014. “Subsidies.” In *Environmental and Natural Resource Economics: An Encyclopedia*, edited by Timothy Haab and John C. Whitehead, 293–95. Greenwood.

Hicks, John R. 1939. “The Foundations of Welfare Economics.” *The Economic Journal* 49 (196): 696–712.

Hirose, Iwao. 2014. *Egalitarianism*. London: Routledge. https://doi.org/10.4324/9781315772004.

Kaldor, Nicholas. 1939. “Welfare Propositions of Economics and Interpersonal Comparisons of Utility.” *The Economic Journal* 49 (195): 549–52.

Kallis, Giorgos, Erik Gómez-Baggethun, and Christos Zografos. 2013. “To Value or Not to Value? That Is Not the Question.” *Ecological Economics* 94 (October):97–105. https://doi.org/10.1016/j.ecolecon.2013.07.002.

Kamm, F. M. 2008. “Should You Save This Child? Gibbard on Intuitions, Contractualism, and Strains of Commitment.” In *Reconciling Our Aims: In Search of Bases for Ethics*, by Allan Gibbard, 120–44. Oxford University Press.

Kaufman, Noah, Alexander R Barron, Wojciech Krawczyk, Peter Marsters, and Haewon McJeon. 2020. “A Near-Term to Net Zero Alternative to the Social Cost of Carbon for Setting Carbon Prices.” *Nature Climate Change* 10 (11): 1010–14.

Kelleher, J. Paul. 2025. *The Social Cost of Carbon: Ethics and the Limits of Climate Change Economics*. Oxford University Press.

Kolstad, Charles, Kevin Urama, John Broome, Annegrete Bruvoll, Micheline Cariño-Olvera, Don Fullerton, Christian Gollier, William Michael Hanemann, Rashid Hassan, and Frank Jotzo. 2014. “Social, Economic and Ethical Concepts and Methods.” In *Climate Change 2014: Mitigation of Climate Change*, edited by O. Edenhofer, R. Pichs-Madruga, Y. Sokona, and et al., 173–248. Cambridge: Cambridge University Press.

Krutilla, John V. 1967. “Conservation Reconsidered.” *The American Economic Review* 57 (4): 777–86.

Manne, Alan. 1999. “Equity, Efficiency, and Discounting.” In *Discounting and Intergenerational Equity*, edited by P. R Portney and J. P Weyant, 111–30. New York, NY: Resources for the Future.

Mas-Colell, Andreu, Michael Dennis Whinston, and Jerry R. Green. 1995. *Microeconomic Theory*. Oxford University Press.

Mellström, Carl, and Magnus Johannesson. 2008. “Crowding out in Blood Donation: Was Titmuss Right?” *Journal of the European Economic Association* 6 (4): 845–63.

Mintz-Woo, Kian. 2022. “Carbon Pricing Ethics.” *Philosophy Compass* 17 (1): e12803. https://doi.org/10.1111/phc3.12803.

Mintz-Woo, Kian. 2024. “Carbon Tax Ethics.” *WIREs Climate Change* 15 (1): e858. https://doi.org/10.1002/wcc.858.

Negishi, Takashi. 1960. “Welfare Economics and Existence of an Equilibrium for a Competitive Economy.” *Metroeconomica* 12 (2-3): 92–97.

Nordhaus, William D. 2008. *A Question of Balance*. Yale University Press.

———. 2013. “Integrated Economic and Climate Modeling.” In *Handbook of Computable General Equilibrium Modeling*, edited by Peter B. Dixon and Dale W. Jorgenson, 1069–1131. Elsevier.

Nozick, Robert. 1974. *Anarchy, State, and Utopia*. New York: Basic Books.

OECD. 2022. *Pricing Greenhouse Gas Emissions: Turning Climate Targets into Climate Action*. Paris: Organisation for Economic Co-operation and Development. https://www.oecd-ilibrary.org/taxation/pricing-greenhouse-gas-emissions_e9778969-en.

O’Neill, John. 2017. “Pluralism and Incommensurability.” In *Routledge Handbook of Ecological Economics*, 227–36. Routledge.

Page, Edward A. 2011. “Cosmopolitanism, Climate Change, and Greenhouse Emissions Trading.” *International Theory* 3 (1): 37–69. https://doi.org/10.1017/S1752971910000333.

———. 2012. “The Hidden Costs of Carbon Commodification: Emissions Trading, Political Legitimacy and Procedural Justice.” *Democratization* 19 (5): 932–50. https://doi.org/10.1080/13510347.2012.709689.

Parfit, Derek. 1995. “Equality or Priority?” In . University of Kansas Kansas. http://aristotle.rutgers.edu/joomlatools-files/docman-files/3ParfitEqualityorPriority2000.pdf.

Phaneuf, Daniel J., and Till Requate. 2016. *A Course in Environmental Economics: Theory, Policy, and Practice*. Cambridge University Press.

Pigou, Arthur Cecil. 1932. *The Economics of Welfare*. 4th ed. London: Macmillan and Co.

Raz, Joseph. 1985. “Value Incommensurability: Some Preliminaries.” *Proceedings of the Aristotelian Society* 86:117–34.

Reiss, Julian. 2013. *Philosophy of Economics: A Contemporary Introduction*. Routledge. https://www.taylorfrancis.com/books/mono/10.4324/9780203559062/philosophy-economics-julian-reiss.

Robinson, Lisa A., James K. Hammitt, and Richard J. Zeckhauser. 2016. "Attention to Distribution in U.S. Regulatory Analyses." *Review of Environmental Economics and Policy* 10 (2): 308–28. https://doi.org/10.1093/reep/rew011.

Ross, W.D. 1930. *The Right and the Good*. Oxford: Oxford University Press.

Sagoff, Mark. 2004. *Price, Principle, and the Environment*. Cambridge University Press.

Sandel, Michael J. 1998. *What Money Can't Buy: The Moral Limits of Markets*. The Tanner Lectures on Human Values. Brasenose College, Oxford.

———. 2012. *What Money Can't Buy: The Moral Limits of Markets*. Macmillan.

Satz, Debra. 2010. *Why Some Things Should Not Be for Sale: The Moral Limits of Markets*. Oxford University Press.

Schmidtz, David. 2023. "Cost-Benefit Analysis." In *The Routledge Companion to Environmental Ethics*, edited by Benjamin Hale, Andrew Light, and Lydia A Lawhon, 685–95. Routledge.

Sen, Amartya. 2000. "The Discipline of Cost-Benefit Analysis." *The Journal of Legal Studies* 29 (S2): 931–52.

———. 2009. *The Idea of Justice*. Penguin Books London.

Sher, Itai. 2020. "How Perspective-Based Aggregation Undermines the Pareto Principle." *Politics, Philosophy & Economics* 19 (2): 182–205.

Spash, Clive L. 2010. "The Brave New World of Carbon Trading." *New Political Economy* 15 (2): 169–95. https://doi.org/10.1080/13563460903556049.

Stern, Nicholas. 2007. *The Economics of Climate Change: The Stern Review*. Cambridge, UK: Cambridge University Press.

Suzumura, Kotaro. 2011. "Welfarism, Individual Rights, and Procedural Fairness." In *Handbook of Social Choice and Welfare*, 2:605–85. Elsevier. https://www.sciencedirect.com/science/article/pii/S0169721810000237.

Tank, Lukas. 2020. "The Unfair Burdens Argument Against Carbon Pricing." *Journal of Applied Philosophy* 37 (4): 612–27. https://doi.org/10.1111/japp.12429.

Thoma, Johanna. 2023. "Social Science, Policy and Democracy." *Philosophy & Public Affairs*. https://doi.org/10.1111/papa.12250.

Thrasher, John. 2017. "Social Contractarianism." In *The Routledge Handbook of Libertarianism*, edited by Jason Brennan, Bas van der Vossen, and David Schmidtz, 212–24. Routledge.

Tietenberg, Tom, and Lynne Lewis. 2018. *Environmental and Natural Resource Economics*. 11th ed. New York: Routledge. https://doi.org/10.4324/9781315208343.

Titmuss, Richard. 2018. *The Gift Relationship: From Human Blood to Social Policy*. Policy Press.

Titmuss, Richard Morris. 1970. *The Gift Relationship: From Human Blood to Social Policy*. Allen & Unwin.

Vatn, Arild. 2000. "The Environment as a Commodity." *Environmental Values* 9 (4): 493–509.

West, Sarah E., and Roberton C. Williams III. 2004. "Estimates from a Consumer Demand System: Implications for the Incidence of Environmental Taxes." *Journal of Environmental Economics and Management* 47 (3): 535–58.

Weymark, John A. 2016. "Social Welfare Functions." In *The Oxford Handbook of Well-Being and Public Policy*, 126–59. Oxford University Press.

Zwolinski, Matt. 2014. “Libertarianism and Pollution.” *Philosophy & Public Policy Quarterly* 32 (3/4): 9–21.

Table 1—Frameworks for Policy Choice

Framework	Description	Representative Philosophical Discussion	Representative Economic Discussion or Use
Pareto Efficiency	No reallocation can make one person better off without making anyone worse off	Broome (1991); Sher (2020)	Pigou (1932); Arrow and Hahn (1983); Heal (1991)
Negishi Formulation	A specific Pareto efficient allocation which is a Pareto improvement relative to a baseline allocation	Kelleher (2025)	Nordhaus (2008); Nordhaus (2013); Manne (1999)
Kaldor-Hicks Framework	Concerned to identify changes that makes Pareto improvements possible. A change that enhances Kaldor-Hicks efficiency need not be an actual Pareto improvement.	Hausman, McPherson, and Satz (2016); Broome (forthcoming)	Baumol and Oates (1988); Goulder and Williams (2012)
Utilitarianism	Maximize a social welfare function comprised of cardinal and interpersonally comparable individual utility/well-being functions; committed to impartiality	Broome (1991); Hausman (1995)	Stern (2007); Budolfson et al. (2021)
Prioritarianism	Maximize a social welfare function that favors more equal allocations	Adler (2012); Fleurbaey (2010)	Adler (2020); Ferranna and Fleurbaey (2022)
Deontological Frameworks	Duties can impose hard constraints against promoting solely welfare; libertarianism is an example	Anderson (1995); Kamm (2008); Zwolinski (2014)	Baumol (1972); Kaufman et al. (2020)

Table 2—Objections to Pollution as Policy Enforcement

Objection	Description	Relevant philosophical discussions (not necessarily endorsements)
Commodification	Placing a price on pollution improperly treats the natural environment as a market good	Caney and Hepburn (2011); Aldred (2012); Sagoff (2004)
Collective Responsibility	We all have some duties that cannot be waived through paying a price, including refraining from polluting excessively	Sandel (2012)
Incommensurability	The value of environmental goods cannot be monetized and compared to the value of market goods	O'Neill (2017)
Crowding Out	Pricing pollution will reduce intrinsic motives to reduce pollution	Bazin, Ballet, and Touahri (2004); Bowles (2016)