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Carbon pricing ethics

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Abstract

The three main types of policies for addressing climate change are command and control regulation, carbon taxes (or price instruments), and cap and trade (or quantity instruments). The first question in the ethics of carbon pricing is whether the latter two (price and quantity instruments) are preferable to command and control regulation. The second question is, if so, how should we evaluate the relative merits of price and quantity instruments. I canvass relevant arguments to explain different ways of addressing these important policy questions, suggesting that carbon pricing is preferable to command and control regulation, and that price instruments have the theoretical edge over quantity instruments.

1 | INTRODUCTION

A common intuition about polluting the environment is that it should not be costless. This is not only because we might resent or wish to punish those who pollute, but also because, if pollution is costly, then there are incentives to avoid or reduce polluting activities. Pollution is an example of what economists call an *externality*. Externalities of an action are its effects on third parties who cannot prevent the action, where the costs of these effects are not faced by the actor. If we do not make the actors face those costs (by *internalizing the externalities*), the results will be predictable. If the external effects are harmful (*negative externalities*), we should expect there will be too much of this activity. In short, beyond the unfairness of permitting costless pollution, not pricing externalities also predictably leads to overpollution because of misaligned incentives.

We can apply this concept to climate change, which has been called the largest externality ever seen (Stern, 2007, p. xviii).[1] In the case of climate change, if we do not make it more costly to emit greenhouse gases like carbon dioxide, the negative externalities of emissions (namely, damaging climate impacts) should lead us to expect that carbon will be overproduced, since producers do not face the full cost of production.[2] In short, we can expect market failure to result from omitting the internalization of externalities.

Assuming we want to reduce emissions, the first question is: (1) should we price carbon or not? If not, the usual alternative to address emissions is through command and control regulation, which prohibits or sets specific limits on emissions. While such regulation may be appropriate in some cases, there are several reasons to believe that carbon pricing policies are generally more effective as well as being morally superior. In particular, although it may be less obvious to consumers, command and control regulation also has the effect of raising the price of emitting—only without the flexibility for producers that carbon pricing allows.

Supposing we want to price carbon, these considerations raise a second question: (2) should we use cap and trade or carbon taxes? In other words, should we use "quantity instruments" that limit the amount of emissions or "price instruments" that add a fixed cost to each additional ton of emissions? In principle, there is little difference. Under idealized market assumptions, limiting emissions to the socially optimal quantity will result in the socially optimal price and vice versa (Broome, 2012; Jamieson, 2014). In practice, there are many reasons that may favor one over the other. For instance, from a political economy point of view, carbon taxes have an advantage over cap and trade: there are fewer opportunities to carve out hidden exemptions.

The purpose of this survey is to introduce these issues to a philosophical audience since they are practically important and could benefit from philosophical reflection. I suggest that, given the scale of climate change, the practical difference between pricing and not pricing carbon can be expected to be greater and more critical than whether we choose either price and quantity *instruments* to price carbon (Jamieson, 2014, p. 236; Shue, 2013). However, comparing the merits of these instruments helps to highlight the considerations which are philosophically relevant.

2 | SHOULD WE PRICE CARBON?

Political scientists consider three main ways governments can induce emission reductions: *command and control regulation*, *price instruments* ("carbon taxes"), and *quantity instruments* ("cap and trade" or "emissions trading schemes") (Caney & Hepburn, 2011). The latter two instruments, carbon taxes and cap and trade schemes, are jointly referred to as *carbon pricing policies* (sometimes, "market-based instruments").

Here's an illustration. Suppose you are going trick-or-treating for Halloween. Command and control regulations are like saying: "no candy" (or, if being less strict, "no going to more than four houses" or "you can't take more than one candy per house"). Price instruments are like saying: "for each five candies, you have to do a chore" (or "for each five candies, you have to give me one"). Quantity instruments are like saying "you and your sister can only eat a total of 20 candies, but it's up to you to trade or decide amongst yourselves how the candy gets divided." (This might lead to various different solutions, including you negotiating so that you get all the chocolates you like and she gets all the sours she likes, or perhaps one person gets more of the total because that person carried more candy or they would rather trade chores for candy).

2.1 | Arguments for carbon pricing

Carbon pricing also has several advantages over command and control regulations: it is flexible, comprehensive, dynamically efficient, subject to double dividends, and has lower epistemic demands. In the Halloween analogy, this is similar to how much extra information you would need to set rules about gathering candy (command and control regulation). You would need to know how many houses there are and what candy each houses gives as well as how unhealthy the different candies are. In comparison, it is relatively straightforward to set general rules about when the candies are to be eaten or distributed. Let us consider the advantages in turn.

First, carbon pricing can be more *flexible* for producers since it does not mandate some particular level of a given technology, but rewards companies for reducing their emissions, regardless of the strategies they use to do so (Singer, 2002, p. 46). For instance, if a company can cheaply reduce its emission beyond the level required by command and

control regulation, they do not have an incentive to do so under the regulation, whereas if another company finds it expensive to do so, it has no recourse under the regulation (Caney & Hepburn, 2011). With carbon pricing, in cases of the first type, there are incentives to continue to reduce emissions and, in cases of the second type, there are possibilities to continue business, although with a proportionate financial penalty.

Second, carbon pricing is more easily made *comprehensive* for regulators than command and control regulations, since this method does not have to target specific sectors (Gajevic Sayegh, 2019). A command and control regulation that sets an emissions standard for cars is difficult to harmonize with another that sets a percentage of renewable energy sources, whereas a price on carbon can easily be extended across both sectors based on both sectors' emissions.

Third, carbon pricing is *dynamically efficient*, since it not only disincentivizes emissions-intensive purchases now, but also provides a signal for future innovation into emissions reductions (Baranzini et al., 2017). If firms are aware that there will be material gains to decarbonizing their processes, or that prices for consumers will be lower for less emissions-intensive alternatives to existing products, carbon pricing encourages them to develop these alternatives.

Fourth, unlike command and control regulation, pricing carbon can result in a *double dividend*, whereby it has two beneficial effects: disincentivizing carbon use *and* recycling the revenues to improve the economy more broadly. Since pricing carbon generates tax or auction revenue for the government (unlike command and control regulation), these revenues can be recycled. The standard double dividend literature considers using tax revenues to offset or remove distortionary taxes (such as consumption or labor taxes). In short, we can use this policy to tax bad things like pollution while removing taxes on good things like consumption, yielding two simultaneous types of benefits (discouraging pollution and encouraging consumption) (Tullock, 1967). However, this use of tax revenues from carbon pricing can conflict with other potential uses of tax revenue, such as public spending on social goods like global sanitation and access to water and electricity (Jakob et al., 2018) or simple equal per capita distribution, as discussed below and advocated by Eggleston (2020) and Budolfson (2021). One might reasonably be concerned that tax revenue is not recycled in such potentially valuable ways. In practice, while almost all jurisdictions have specified the uses of their revenue, not all have aimed at the kind of tax shift that the theory of double dividend is built on. For instance, in Canada, the British Columbian carbon tax was accompanied by a tax shift, meaning that other taxes were reduced (Yamazaki, 2017). In comparison, in the Irish case, increased carbon tax revenues are ring-fenced for broadly related public spending, such as for protecting the energy poor, for investing in a just transition for workers, and for green public infrastructure (Ireland Department of the Environment, Climate and Communications, 2021). Indeed, Yamazaki (2017) found evidence that the kind of tax shift enacted in British Columbia did result in a double dividend, resulting in a small, but statistically significant increase in employment rates.

Finally, command and control regulations often face higher *epistemic burdens* for regulators (Baranzini et al., 2017; Caney & Hepburn, 2011). While this need not be true in general (cf. Cole & Grossman, 1999), in the context of limiting pollution, it is relatively difficult to design economically efficient regulation. Not only do regulators need to know either the socially optimal quantity or price of carbon, they also need to understand how the producers' processes contribute to carbon emissions in order to set optimal standards for that sector (Eggleston, 2020). After pricing carbon, market pressures more directly determine how the producer will respond. One response is that monitoring compliance with regulation may be more straightforward than carbon pricing (since it can be done periodically instead of continuously). However, as carbon emissions data becomes easier to deliver continuously, this may become less of a problem in the future.

However, command and control regulation has a key advantage—namely, its potential political feasibility—which is discussed in the next subsection.

2.2 | Arguments against carbon pricing

First, an important concern with carbon pricing is that, in some regions, command and control regulations, such as renewable portfolio standards, are more *politically feasible* (Green, 2021b). Renewable portfolio standards requires

a certain percentage of energy supplied be generated from renewable sources. Some research suggests that, in the United States, such policies increase support for climate policies (Green, 2021a). However, it is worth considering why such portfolio approaches may command public support, especially compared to carbon pricing policies.

The primary reason is that the costs of command and control regulation are hidden from consumers—but this just means that consumers are not recognizing the costs which do accrue. To illustrate, if a renewable portfolio standard is needed, we can infer that without it the market would undersupply renewable energy. If so, a renewable portfolio standard leads the suppliers to buy more renewable energy than they would otherwise have, that is, they buy a more expensive source of energy. In general, that extra price will lead to more expensive energy for the consumer. Although command and control regulation is not in the pricing carbon category, it *results* in pricing carbon.

This generalizes to other command and control regulations; if they are working, these regulations force companies to purchase or produce products which are not the most economical for them. We can expect that consumers will shoulder some of these costs. The purpose of this argument is not to say that command and control regulation is unjustifiable; it is simply to show that a primary political benefit is unwarranted.

Second, some object to pricing carbon for both theoretical and practical reasons relating to paying to emit. Theoretically, pricing carbon *commodifies the environment* in ways that some believe is immoral (Aldred, 2012; Caney, 2010; Caney & Hepburn, 2011; Francis, 2015). For instance, owning (and selling) some part of the absorptive capacity of the environment might seem morally objectionable. Practically, some have objected that this could crowd out moral motivations since a *fee is different from a fine* (Sandel, 2012). If we charge people a fee to emit (via a carbon price), they might feel licensed to do it in a way that they wouldn't if they were fined for emitting (via command and control legislation).

With respect to the first, Caney (2010) and others have shown that such schemes need not imply ownership of the environment in an objectionable way, since emissions rights can be "use" rights instead of "private property" rights. With respect to the second, Baranzini et al. (2017) survey a literature that suggests carbon pricing might actually not displace motivations, but increase them.

However, there is a deeper, unrecognized disagreement between those who view emitting as generally immoral (so emissions should be fined and controlled) and those who think a significant amount of emissions are justified (so emissions should be disincentivized and priced). Call this the *generally* versus *marginally wrong* framing. If we want to signal that we think emitting carbon dioxide is generally wrong, we should signal our disapproval by regulating or disallowing it (and fining those who emit). If we want to allow for emissions where the benefits outweigh the costs, we should incentivize actions that have sufficiently valuable uses of emissions.

On the latter side are those who believe that it is not *always* (or not *generally*) impermissible to emit carbon, since there are many morally justifiable uses of emissions (Shue, 2013), but that it *is* morally impermissible to emit when you do not face the costs of doing so. In the Halloween metaphor, we can all agree that each additional candy is a little worse for you, but that doesn't necessarily mean that no one should be allowed to eat *any*. This can be motivated by the expectation that if there are externalities, there will be market failures and, in the long-term, internalizing externalities corrects incentives and generates aggregate benefits (Mintz-Woo & Leroux, 2021). Interestingly, although Sandel was one of the first to object to pricing policies on the basis of introducing fees instead of fines, he has since shifted somewhat on the framing question precisely because "emitting carbon dioxide is not in itself objectionable" (2012, p. 73).[3]

Finally, the goal of reducing emissions might *conflict with the goal of raising revenue* from the carbon pricing (discussed further below).[4] The concern is that any successful carbon pricing scheme will drive emissions down, reducing the number of emissions subject to the carbon price. One might conclude that successful carbon pricing will not produce meaningful revenue.

However, Jakob et al. (2018) point out that this elides the question of *how* the price changes as the emissions are reduced. They report recent modeling results which suggest that total revenue could increase year after year until 2040, even while emissions decrease in a manner consistent with globally agreed climate targets.

3 | HOW OUGHT WE PRICE CARBON?

Carbon pricing can be enacted via *price instruments*, which put a direct price on emissions that are embodied in or associated with a product or service, or *quantity instruments*, which set a cap on emissions and allocate tradeable rights to emit up to that cap. The basic tradeoff is between predictability of price (which is valuable for activities like private sector planning) and predictability of emissions reductions (which is valuable for environmental planning). In the Halloween example, this is like the predictability of the cost for each additional candy eaten versus the predictability of setting a total candy limit.

To give a sense of impact, estimates of optimal carbon prices vary greatly depending on both moral (Davidson, 2015; Drupp et al., 2018; Greaves, 2017; Jamieson, 2014; Mintz-Woo, 2018, 2021a) and empirical assumptions (Fleurbaey et al., 2019; Mintz-Woo, 2021b). However, to give a representative order of magnitude, we can say that reasonable estimates range from \$30 to \$200USD/tCO_2 (which is a cost per marginal or additional metric ton of carbon dioxide). Those estimates would raise equivalent gasoline prices by approximately \$0.30–\$2.00/gallon (cf. Wang et al., 2019). These moral and empirical assumptions generate social costs of carbon using integrated assessment models (Mintz-Woo, 2021b). Furthermore, it is important to note that the gains of addressing climate change are not limited to climate effects. There may be sizeable *co-benefits* (and *co-harms*) in addition to climate effects, including local and short-term health gains (Green, 2015; Karlsson et al., 2020; Scovronick et al., 2019; Watts et al., 2021); such co-benefits have received little attention in the philosophical literature, despite their potential political importance.

While both forms of carbon pricing in principle help incentivize carbon reduction, there may be reasons to favor one over the other. There is a conflicting body of empirical work about whether carbon pricing or regulation is more effective in reducing emissions (e.g., Green, 2021a; Haites, 2018; Haites et al., 2018; Narassimhan et al., 2018), which has led some experts (especially economists) to favor carbon taxes (High-Level Commission on Carbon Prices, 2017), and other experts (especially political scientists) to favor regulatory instruments (Green, 2021a; Mildenberger, 2020; Stokes, 2020). Meanwhile, political decision-makers are beginning to come together in endorsing carbon prices (Hook & Talman, 2021).

3.1 | Objections to quantity instruments alone

While the philosophical literature evaluating the relative merits of price and quantity instruments is limited, we begin with the more developed literature in moral and political philosophy criticizing quantity instruments (Aldred, 2012; Caney, 2010; Caney & Hepburn, 2011; Goodin, 1994; Page, 2011a, 2011b; with literature surveys by Page, 2013; Dirix et al., 2016).

First, we might think it ethically objectionable to *pay for others to reduce* their emissions while continuing to emit (Page, 2011a, 2013; Sandel, 2012). The idea here is that we should bear our own burdens and using resources to make others do the work is shirking it in some morally important sense. One response is that our resources might go much further than we can ourselves, especially when the relative power of dollars or Euros in the developing world is taken into account (MacAskill, 2015). Aldred (2012) goes further, arguing that all emissions cause some damage, so *no* amount of emissions should be allowed, meaning that no quantity is appropriate. However, some uses of emissions are morally justifiable: if an ambulance uses energy to get someone to an emergency surgery, we would all view that as morally justifiable even if we accept that the emissions associated with that energy will cause some climate harms in expectation (this thought experiment also supports considering climate emissions in the marginally wrong as opposed to generally wrong category).

Second, politically influential *environmental justice* objections have been raised against quantity instruments (Drury et al., 1999; Kaswan, 2008). The concern is that, if racial or economic equity is not built into new policies, difficult to abate emissions will be (re)located to places where either (a) it is cheaper to pollute or (b) there is a lack of politically powerful constituents who can lobby against those emissions. In both cases, there is reason to believe that these

would track already marginalized communities, especially communities of color, further disadvantaging them. The quantity instrument RECLAIM in Southern California has attracted particular attention in this regard. While different interpretations of the data are possible, one influential and carefully controlled study by Fowlie et al. (2012) found no evidence that quantity instruments for the air pollutants NO_x led to demographically sensitive increases in emissions, suggesting that this may be more of a problem in principle than in practice.

Third, a *solidarity objection* posits that paying for other emissions reductions such as in the developing world undermines global cooperation (Aldred, 2012; Sandel, 2012). The concern is that, if developed countries pay the developing world, not everyone will be contributing in an appropriate manner. One response is that the developing world is currently demanding resources to address climate mitigation and adaptation (e.g., Green Climate Fund), so climate negotiations are in some sense blocked by insufficient climate finance. If that finance helped generate mitigation activity, this could be a win-win.

Finally, we can consider a *carbon cosmopolitan* objection that quantity instruments are inconsistent with cosmopolitanism (Page, 2011b).[5] Page is concerned that it is difficult to develop a quantity instrument in a global way that respects procedural justice given unequal powers between countries. This is an important worry, but as discussed below quantity instruments mostly act as national policies at this point, with the national policies supporting nationally determined contributions to climate goals. In short, we should expect this to be a greater problem if the quantity instruments were developed with international cooperation (and debate), but that is not how they are being introduced, so this is less of a problem than it might appear.

While there is much more to say about these arguments, Page (2013) and Dirix et al. (2016) conclude that the objections can be met if the quantity instruments are sufficiently well-designed, such as with transparent permit auctions and distributively sensitive use of the resulting auction revenue.

3.2 | Comparing price and quantity instruments

There has been less philosophical literature that explicitly considers the relative merits of the two types of instruments.

First, we could criticize quantity instruments by arguing that they provide too many potential choice points in policy formation, ranging from whether to auction or freely give permits to how to treat financial industry mediators of emissions trades and whether to allow outside offsets to be included (Spash, 2010). We can call this the *option maladministration* objection to quantity instruments. If there are many choice points, there are both many ways for the policy to go wrong and many opportunities for vested interests to corrupt the policy. Furthermore, if there is a relatively generous allowance in one country or sector, that could reduce pressure on other countries or sectors under a quantity instrument, but not under a price or regulatory instrument. Spash concludes that these considerations favor price and regulatory instruments as more simplistic. However, each policy allows for some such maladministration: command and control regulation also involves many choices in instrument design and sector lobbying for tax exemptions could provide related challenges to price instruments (Stavins, 2008). However, when comparing the three choices, the smaller scope for legislative machination when implementing price instruments is perhaps a key political economy consideration in their favor (Budolfson, 2021).

Second, comparing price with quantity instruments, Gesang (2013) suggests that price instruments have two distinct disadvantages compared to quantity instruments. First, he suggests that emissions reductions could be *canceled out* either by consumer behavior or by oil producers lowering their prices to offset the increased carbon tax whereas reductions are fixed by quantity instruments. Second, Gesang argues that utilitarians should support quantity instruments over price instruments because they could *promote global distributive justice* by providing resources to poorer (lower carbon emitting) regions of the world, which could help address global poverty (cf. Singer, 2002). He admits that there is no principled reason that would prevent global distribution of revenues from carbon taxes, but suggests that giving emissions permissions the status of legal rights would enshrine them in global law more forcefully—both legally and psychologically—than with price instruments.

While it is certainly the case that emissions reductions are guaranteed by quantity instruments (by definition) (Dales, 1968), the idea that emissions reductions would be canceled out are either unconvincing or easily rebutted. Firstly, in principle, if the consumers or producers are willing to pay the social cost of carbon, then their uses for it are sufficiently valuable, at least in standard economic terms (not all uses of carbon are unjustifiable). Secondly, if they simply pay, they are contributing to potential revenue recycling. However, the more fundamental point is that there is empirical evidence that internalizing externalities does affect behavior (Mintz-Woo, 2021c), not only with climate change (Best et al., 2020), but also for even more inelastic items, like addictive cigarettes (Hu et al., 1995). The main response to Gesang's concerns is that these concerns do not reflect thinking "on the margin," meaning about how those who are close to indifferent choose. If the carbon tax is higher, the effective number of such marginal consumers or producers is larger, so we can expect more change in choices (Mintz-Woo, 2021c).

Gesang's second objection, about the likelihood of global redistribution, is more speculative, as current policies do not have this global character. It is certainly not an intrinsic feature of quantity instruments that global reductions would contribute to national reductions. Indeed, there is a morally relevant point about whether carbon prices should be harmonized as a *global carbon price* anyways. On the one hand, a global carbon price would reduce the likelihood of leakage; if everyone paid the same, there would be no incentive to move production or consumption elsewhere (Nordhaus, 2015; Weitzman, 2014, 2017). On the other hand, differentiated prices could reflect the national circumstances, where developing countries might have greater immediate needs or more difficulty accessing productive long-term financial products (Bataille et al., 2018; Stiglitz, 2019).

Regardless of our moral judgments, current price and quantity instruments are overwhelmingly national, with the revenue being used nationally. (A large and important exception is the European Union's Emissions Trading Scheme, but the revenues are still distributed within Europe.) One important distinction about the ways that international emissions could count towards a cap is between *linking schemes* or *allowing offsetting*. When trading schemes are linked, members of one trading scheme can buy and sell permits to pollute from the other scheme. This could happen if two regions both have well-functioning markets but want to coordinate them to allow for greater comprehensiveness. Another option is where someone within a scheme is allowed to count as credits mitigation reductions abroad (assuming the offsets are real offsets, or that they satisfy *additionality* and *verifiability* [Mintz-Woo, forthcoming]) as "offsetting" their domestic emissions (preferences and equity issues in offsetting are discussed by Baranzini et al., 2018; Buntaine & Prather, 2018; Diederich & Goeschl, 2018). On the one hand, requiring—or making it a legal entitlement—that emission rights be recognized globally could indeed raise the likelihood of global transfers as compared with price instruments. Stavins (2008) adds that global redistribution of tax revenue would have to be done by local governments, whereas revenue from selling emissions permits can take place directly between firms, even internationally. On the other hand, national distribution of resources may be fundamental to political feasibility (Carattini et al., 2018; Klenert et al., 2018). Some have argued about whether, for the sake of feasibility, (global) distributive justice considerations should be sidelined to increase the likelihood of a global policy agreement (Gardiner, 2021; Gardiner & Weisbach, 2016; Weisbach, 2021). Interestingly, Page (2011a) demurs, suggesting that marginalized members of the global community may be unable to "resist" reducing their emissions in exchange for resources. In short, what Gesang sees as an important goal of global carbon pricing—the ability for less developed countries to sell emissions rights—presents a concern for Page. However, carbon pricing has been generally national, so these concerns remain difficult to adjudicate.

Third, another objection to carbon pricing in general is that those who can afford to shoulder the costs will continue emitting (and many of them may not find the cost burdensome) whereas those who are less affluent will find these same costs relatively difficult to bear. Tank (2020) calls this the *unfair burdens* argument. More technically, the costs of carbon pricing appear regressive in taxation terms, meaning that the costs to those with lower income are proportionately higher than the costs to those who are more affluent, or at least this can be expected to be the case (Caney & Hepburn, 2011). For instance, if you are less affluent, a greater proportion of your monthly spending may be on carbon-intensive essentials (heating, commuting) whereas those who are more affluent may spend more proportionately on relatively low-carbon status goods (art, fine dining). Tank concludes that morally justifiable versions

of carbon pricing should incorporate prices that generate progressive distributions (e.g., those who are poorer should pay less to emit the same amount than those who are wealthier).

It is first worth noting that a companions in guilt response could be offered, as alternatives to carbon pricing, such as renewable subsidies, are often themselves regressive. This can be because they tend to apply to homeowners (solar panels are usually only an option for owners as opposed to renters, who tend to be higher on the income scale) and because they require up-front investment so favor those who have more liquid assets (Allan & McIntyre, 2017; Borenstein, 2017).

However, even considering this objection on its own terms, it is not necessarily convincing. Eggleston (2020) considers and rejects a similar unfair burdens argument, arguing that the distributive justice concerns are trumped by political feasibility. He defends an equal per capita use of revenue (i.e., where the revenue is divided up equally for everyone without intentional regard to progressivity) as a system whereby everyone sees practical gains and there is no possibility for the program to be seen as a covertly redistributive policy.

Mintz-Woo (2021c) responds to Tank that regressivity is an implication of carbon taxes only if we are considering the direct costs of a carbon tax but not using the revenue to offset any distributive injustice (also cf. Baranzini et al., 2017). Counterintuitively, even if the direct effects of the tax (the *initial incidence of the tax*, as economists say) are regressive *and* the resources are simply distributed equally per capita, the net effect can be progressive. In other words, we surprisingly do *not* need to have progressive initial incidence in order to get overall progressive outcomes; a simple equal per capita use of revenue can achieve this end.

A toy example may help to illustrate this. Suppose you are much richer than I am and spend $10,000/month. I only spend $1000/month. A carbon tax is introduced and, because the initial incidence of a carbon tax is regressive, it hits me harder. Let us say that you end up being taxed effectively at 5% so you spend $500/month on this carbon tax. However, we assumed that the initial incidence is regressive since, for instance, more of my monthly spending is on products like gas. Suppose I end up being taxed 10% or $100/month. Now let us suppose the government simply divides up all the revenue and, using equal per capita distribution (i.e., without reference to anyone's wealth or contribution size), provides both of us with [$500/month + $100/month]÷ 2 people = $300/month/person. You end up net $200/month down (– $500/month + $300/month) but I end up $200/month up (– $100/month + $300/month). In other words, even though the initial incidence of the tax we assumed to be regressive *and* even though we rebated the tax revenue in a non-progressive (simply flat) way, the net result is still a progressive transfer from the richer to the poorer!

This effect is even more pronounced when we consider the fact that, in poorer countries (e.g., where per capita GDP is below $8000), the *initial* incidence might even be progressive and not regressive (Dorband et al., 2019). Early studies by Cao (2012) and Datta (2012) (as well as others in Sterner, 2012) find that the initial incidence of gasoline taxes would be progressive in China and India, respectively. If these resources were used to produce social goods that further benefitted the least well-off, then we might procure extra-progressive outcomes. Pace Caney and Hepburn (2011), it is not generally the case that carbon pricing is regressive; to the contrary, in much of the developing world, evidence suggests carbon pricing is *progressive*.

Finally, these distributional possibilities raise another objection to carbon prices where the resources are all returned to the public. If this is so, would they ultimately set the *right incentives*? In other words, if the revenue is being returned, where is the motivation to reduce emissions? Eggleston (2020) responds:

> the *collective* financial impact will be neutralized, but each *individual* will still have virtually the same incentive to choose low-emissions activities over high-emissions ones. If my city told me it was going to institute this kind of rebate program to disburse the proceeds of parking tickets every year, it would still be in my interest to avoid getting parking tickets. (72, emphases in original)

4 | CONCLUSIONS AND OPEN QUESTIONS

This survey suggests that there are significant advantages to pricing carbon, either via carbon taxes or cap and trade, relative to command and control regulation. Between the carbon pricing options, the theoretical reasons may be somewhat stronger for carbon taxes. However, as mentioned above, we can expect that the relative gain of either over the status quo is considerably greater than the marginal difference between the two. In the Halloween analogy, if we are currently just letting the children gorge themselves, the difference between continuing to do so and setting some total amount or setting some cost for each additional candy could be much larger than the difference *between* the two types of limitations.

Regardless, there remain several other open research questions. The most philosophically rich one has to do with evaluating options for recycling revenue, either from cap and trade auctions or from carbon taxes. One revenue recycling classification by Steenkamp (2021) asks whether the uses for revenue (i) are directed to specific projects or used for general purposes; (ii) return *all* of the revenue; (iii) match public preferences (such as redistribution or environmental benefits) (cf. Beiser-McGrath & Bernauer, 2019); or (iv) balance different "thematic" desiderata. There are several potential desiderata for a policy, ranging from minimizing emissions to increasing market efficiency (e.g., reducing other distortionary taxes) and from offsetting distributional regressivity (e.g., which, as noted above, can be accomplished via simple per capita rebating) to even assisting affected stakeholders. For instance, Broome (2012) believes the revenue should be used to contribute to the resources needed to buy off stakeholders who would otherwise object, even though he takes this to be morally non-optimal. How we weight these different goals or answer these classification questions will have major implications for how the policy is to be designed.

Another question is whether the arguments for carbon pricing should be extended further, to a broader project of internalizing externalities (Mintz-Woo & Leroux, 2021). For instance, some have argued that parallel reasoning supports internalizing externalities that apply to long-term problems (Mintz-Woo, in preparation). Perhaps we should tax leaving debris in space, where it makes space travel riskier, or overusing antibiotics in animal agriculture, reducing antibiotic resistance and reducing our protection from pathogens. Just as we should incentivize people to care about the climate, perhaps we should incentivize people to respond to the other long-term challenges we face.

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CONFLICTS OF INTEREST

The author declares no potential conflicts of interest.

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ENDNOTES

[1] More precisely, he called climate change the greatest market failure the world has ever seen, where this market failure is due to very large uninternalized externalities.

[2] While this paper discusses carbon pricing (technically, pricing of carbon dioxide), in principle other greenhouse gases can be incorporated into carbon pricing by determining a "carbon dioxide equivalent" (CO_2e) which has an global warming potential equal to a ton of carbon dioxide. However, there are important complexities that go beyond the scope of this review involved in determining equivalence. For instance, some greenhouse gases persist in the atmosphere longer, so the timeframe you are using to determine equivalence can make a significant difference.

[3] Sandel wrote one of the earliest moral objections to pricing carbon in the *New York Times* in 1997, https://www.nytimes.com/1997/12/15/opinion/it-s-immoral-to-buy-the-right-to-pollute.html.

[4] Steenkamp (2021) calls the distinction between policies which return all of the revenue to the public versus spending less than is raised "revenue-neutral" versus "revenue-raising"; Mintz-Woo et al. (2021) call it "revenue-neutral" versus "revenue-positive."

[5] By cosmopolitanism, we mean the theory that duties of justice are owed without regard to nationality.

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