

OXFAM
RESEARCH BACKGROUNDER

Carbon Pricing

A primer for Oxfam

James Morrissey

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OXFAM'S RESEARCH BACKGROUNDEERS

Series editor: Kimberly Pfeifer

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Author information and acknowledgments

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ACRONYMS AND ABBREVIATIONS

CDM	Clean Development Mechanism
COP	Conference of the Parties
CPI	Consumer price index
EPA	Environmental Protection Agency
ETS	Emissions trading system
EU ETS	European Union Emissions Trading System
FPIC	Free, prior and informed consent
GATT	General Agreement on Trade and Tariffs
GHG	Greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
ITMO	Internationally transferred mitigation outcome
NGO	Non-governmental organization
OBA	Output-based allocation
R&D	Research and development
REDD	Reducing emissions from deforestation and forest degradation
UNFCCC	United Nations Framework Convention on Climate Change
WTO	World Trade Organization

EXECUTIVE SUMMARY

Carbon pricing is not a new phenomenon. Backed by widespread consensus in the economic literature that it is the single most-effective policy for addressing climate change, it has been the staple policy priority of many environmental non-governmental organizations (NGOs). Yet carbon pricing has seen limited uptake. Efforts to price carbon have failed in a multitude of contexts. Where they have passed, in most cases, prices have been set too low or covered too little of the economy to effectively address the challenge posed by climate change. As a result, climate advocates have come to question carbon pricing as a primary policy approach. In this context, this paper is not intended to provide novel insights into carbon pricing, nor is it intended to motivate for or against an immediate campaign priority at Oxfam. Rather, this review of carbon pricing is intended to provide a technical background on the topic, considering the concerns that are of greatest salience to Oxfam. The specific aims of the paper are to support Oxfam staff in their deliberation on whether, when, and how to engage on carbon pricing initiatives, as questions around this policy approach shift over the next 20 years. It is anticipated that such reflection would also be useful to a number of organizations whose concerns are similar to Oxfam's.

There are two approaches to placing a price on carbon, both of which arise from viewing climate change as a market failure, specifically a "problem of the commons." The first is to force the individual to internalize the cost of their individual consumption to account for its impact on the commons, via the implementation of a tax. Taxes are common to everyday life, and a carbon tax is no different: you pay an additional fee for any good (or service, hereafter assumed) based on the carbon embedded in its production/consumption. The second approach is to create "use rights" to the commons. Under this approach, actors are required to hold a permit (i.e., a use right) in order to emit CO₂ and have to surrender that permit upon doing so. To make this approach effective for addressing climate change, the number of permits is limited (or "capped"), thereby limiting the quantity of emissions that are possible. Emissions permits are initially either allocated or sold.

Fundamentally, with both a tax and cap, the result is an increase in the cost of activities that emit CO₂, either because of the need to pay a tax or to purchase a permit.¹ This cost is understood as the "carbon price."

¹ Notably, even if, under a cap-and-trade system, the emissions permits are given away rather than sold (a process known as "grandfathering"), they create an incentive to reduce emissions among recipients of the permits. This incentive is created because the recipients will be incentivized to reduce their emissions whenever doing so costs less than the value of the permits, and then to sell the permits. This situation, of

The primary theoretical advantage of emissions pricing, over other policy approaches to addressing climate change, is that it leverages the power of the market to identify the least-cost approach to transitioning the economy away from carbon-emitting technologies. For this reason, carbon pricing efforts are known as “market-based” or “price-based” approaches. Their economic efficiency derives from the fact that they leave the decision of how, and where, to make investments to reduce emissions to individual firms. Since the cheapest pathway for reducing emissions is likely to be firm specific, this approach allows carbon pricing to find the least-cost pathway across the entire economy. Price-based approaches are contrasted with regulatory and standard-setting approaches, in which regulations and standards are used to dictate where emissions reductions should take place—for example, by mandating certain levels of emissions reductions from specific sectors, the use of specific technologies, etc. Since specific choices of top-line technologies are unlikely to be able to identify the cheapest decarbonization pathway for every firm, such an approach is anticipated to be more expensive than emissions pricing.

In addition to being the least cost, emissions pricing approaches are preferred due their avoidance of rebound effects and their capacity to generate revenues. Revenues result from the taxes paid or the sale of permits. It is worth noting that permits can be given away (a process known as “grandfathering”). If subsequent trading of permits is permitted, grandfathering simply confers the value of the permits to the recipients to whom they were grandfathered. Revenues are viewed as a primary advantage of carbon pricing over other efforts to address climate change, as they can be used to address the generally regressive impacts carbon pricing creates for users of carbon-intensive goods and services that result from increasing the price of those goods.

While carbon pricing reflects the least-cost approach to addressing climate change, carbon pricing alone is not thought to be sufficient to efficiently address climate change. The reasons include: i) climate change is not the only market failure limiting investment in low-carbon technologies, and ii) the theory behind carbon pricing relies on a simplified account of utility maximization as the determinant of all human behavior. Numerous examples exist of other market failures, including research and development (R&D) and public transport, both public goods that see underinvestment by the private sector. Thus, carbon pricing will require numerous complementary policies (R&D subsidies, public investment in public transport, and electric vehicle infrastructure) to achieve the least-cost approach to reducing emissions. Regarding human motivations, humans do not make all their decisions simply in terms of minimizing their costs. For example, people don’t just consider value for money when buying a car; they also consider issues of status, identity, and brand loyalty (among others). As

course, does not hold in the case of non-tradeable permits. This issue is discussed more fully in Box 2 on grandfathering.

such, additional complementary policies will be required to account for these motivations and ensure an efficient and ambitious pathway for addressing climate change.

Despite initially seeming quite distinct, a carbon tax and a carbon cap share many similarities, including their ability to: achieve a least-cost pathway; reduce emissions; raise revenues; incorporate exemptions; and recirculate revenues. Further, their distributional impacts and their need for complementary policies are also effectively the same. Their differences pertain primarily to what is known and what is uncertain across the two approaches. For a carbon tax, the price of emissions is known; however, the level of emissions is uncertain. In periods in which economic growth is substantial and demand for energy is high, people might be willing to pay substantial amounts for their energy. Should this amount exceed the level of the carbon tax, emissions will remain high regardless of the tax. For a carbon cap, the level of emissions is certain (as it's created by the cap), while the price of emissions permits is uncertain, effectively creating uncertainty for energy prices. In times of significant economic activity, demand for energy could be substantial, creating large demand for permits. In a context of an emissions cap, the cost of energy would get extremely high.

Since uncertainty in both emissions and energy prices is politically unpalatable, the most likely outcome of carbon pricing is the creation of a hybrid approach. Under such an approach, carbon caps will likely be accompanied by price floors and ceilings. These will ensure that prices don't get too low in times of low demand and don't get too high in times of high demand. This approach limits uncertainty in prices; however, it does so by creating uncertainty in emissions by allowing them to exceed the cap. Under a carbon tax, the hybrid approach will likely include an automatically changing price that responds to whether emissions reductions are taking place at the rate deemed necessary. By doing so, issues of emission uncertainty are addressed; however, these are achieved by introducing uncertainty about prices. Overall then, the specific design of a carbon price is thought more important than the choice between applying a tax or creating a cap. Design elements are numerous and include: the size of the tax/stringency of the cap; the level of the price floor and ceiling (under a cap), and the rate and mechanism for tax adjustment (under a tax); what is done with the revenues; where in the economy the tax/permitting is applied; which complementary policies are enacted; how and whether exemptions are created; and what measures are taken to improve political palatability (all these issues are detailed in this report).

Two central questions stand out regarding the design of a carbon price: i) how the price is set; and ii) how the revenues are used. Emission prices are set using three primary tools. The first is emissions targets, which are best suited to a carbon cap. Emissions targets are derived from reflections on model results of the sensitivity of the earth's temperature to CO₂, studies of the impacts of a

warming atmosphere on human well-being, and reflection on the moral questions of how the costs of climate change should be borne and distributed. The most prominent of these emissions targets come from the Intergovernmental Panel on Climate Change (IPCC). In the case of a carbon cap, one simply sets the cap at the level of the target. The second approach is the use of the social cost of carbon, which represents an effort to estimate the cost associated with impacts of climate change. Such an approach is best suited to a tax, as the tax is simply set at the social cost of carbon, thereby forcing the individual to internalize the costs of their consumption. The third approach is technological roadmaps (for example, aiming for 50 percent of electricity to be produced by renewables). The aim with technological roadmaps is not to set a legislative agenda but rather to determine technology switching prices and to aid in price setting. In all cases, determining the safe level of, or appropriately costing of, emissions is enormously complex (and becoming more complex as emissions continue to rise). As such, ranges for the appropriate level of prices varies substantially, though not to the point that the approach is thought to have no value.

Regarding the use of revenues, the following options appear prominently in the literature: i) recycle revenues into the budget, reducing other taxes, the option preferred by economists for the theoretical gains to overall economic efficiency; ii) return revenues as a lumpsum rebate to citizens, the option preferred for its highly progressive outcomes; iii) invest revenues in complementary low-carbon investments, the option preferred for further advancing action on climate change; iv) pay down sovereign debt, the option preferred for the possibility of crowding in private investment into a sector that is capital intensive; and v) use the revenues to support developing countries to adapt to and mitigate climate change, the option preferred for its positive impact on issues of international equity.

Revenues don't have to be used for a single purpose and can be oriented to do all the above activities. However, a central point is that carbon revenues will dwindle as the economy transitions away from carbon-intensive goods. Plans for the use of revenues should therefore include considerations of what the impacts will be when those revenues dry up.

A look at the status of carbon pricing reveals that, currently, carbon pricing is inadequate. In most cases, prices are too low and/or coverage is too limited to galvanize the sort of action that would be necessary to address dangerous climate change. Nonetheless, carbon pricing is showing a steady expansion in terms of both the share of the economy that is covered and the quantity of revenues raised. However, this increase remains too slow to ameliorate the concerns about the current level/coverage of pricing. The empirical evidence on the impacts of carbon pricing suggest that the theory is largely accurate, but the robustness of this evidence is limited by the lack of ex-post empirical works and the reliance on a single pricing system (the European Union Emissions Trading System (EU ETS)) for most analyses. Some important debate still exists in the literature as to whether carbon pricing will drive the realization of new

technologies that will be needed to transform the global energy system and whether it is carbon pricing or other policy initiatives that have done most of the work in driving emissions reductions to date.

There are numerous forceful arguments against carbon pricing. The two that are of greatest concern to Oxfam pertain to whether carbon pricing is regressive and whether it faces particular political challenges. Regarding the potential regressivity of carbon pricing, while the impact of increased prices for carbon-intensive goods will almost certainly result in regressive impacts, there is some debate as to whether these will be effectively offset by the impact of carbon prices on household sources of income. Such impacts usually depend on policy choices, such as what will be done with the revenues and what will happen to other government transfers. If revenues are recycled back to households on an equal basis, or if they are targeted at low-income households, the overall impacts are expected to be progressive. Likewise, in contexts where social welfare is significant, if government transfers remain pegged to consumer price indices, then the impact of carbon pricing on increasing those indices stands to increase other government transfers to the extent that the overall impact of the price is progressive. In terms of the impact of carbon pricing on the structural factors of the economy, it is thought unlikely that the distribution of gains from these impacts will result in overall progressive outcomes.

Further to issues of income, carbon pricing also has distributional effects based on environmental quality and due to the manifestation of social norms. In both cases, there is real potential for regressive outcomes; however, the evidence for these is currently lacking or debated. Notably, in both cases, the implementation of policies (mainly through the use of revenues) is thought capable of addressing such regressive outcomes.

Regarding the unique political unsuitability of carbon pricing, the criticism is that carbon pricing's transparency (people know exactly what they are paying for the transition), its focus on what people have to give up (compared to, say, public investment in green technologies), its tendency to move towards the lowest common denominator (as a means to marshal a large array of actors behind a single policy), and its lack of durability (due to its limited ability to create a constituency that might be capable of fighting to maintain it) all mean that efforts to achieve a carbon price will face substantial political obstacles. Given the degree to which carbon pricing has failed to achieve the coverage and prices necessary to advance action on climate change, these concerns should be taken seriously. Oxfam should support climate policies that have political momentum, rather than those that are simply thought to be most effective or meet specific criteria.

Regarding ways in which the political palatability of carbon pricing might be improved, research suggests that transparency over what prices will be, how

they will change over time, who they will be applied to, and how revenues will be used, along with active communication strategies on these issues, is essential. Investing revenues in green technology and using them to address the regressive impact of increased prices for carbon-intensive goods are particularly popular. Further, evidence suggests that the political palatability of the specific design of a carbon price will be shaped by prevailing economic and cultural world views of the population where the price is being proposed. Such views include, for example, trust in government and concerns about equity as a core political outcome. To this end, any carbon pricing initiative should consider the specific context in which it is being proposed and should include the consideration of alternative policies to pursue action on climate change.

Regarding core take-aways on a carbon price, Oxfam should only pursue a price:

- If prices are high enough and coverage is broad enough to mobilize sufficient action on climate change;
- if both of the above are to start low and increase over time, then a mechanism is required for increasing both prices and coverage, without the need for galvanizing further political support.
- If that price is accompanied by complementary policies that can address the limitations of price signals for changing preferences;
- If that price is accompanied by policies to address potential regressive impacts based on the impact of carbon pricing on the cost of goods, environmental quality, and the outcome of social norms.

INTRODUCTION

Carbon pricing is not a new idea. It has been a staple policy proposal of environmental NGOs, one that is backed by widespread agreement in the economic literature that placing a price on CO₂ emissions is one of the most effective means for addressing climate change (Stiglitz et al. 2017; CPLC 2016; Carattini, Carvalho, and Fankhauser 2017; Boyce 2018; GRICCE 2018; Stavins 2020). Yet carbon pricing has seen limited success. The US has been unable to achieve a national price, and while some regions and states have been able to pass carbon pricing legislation, others have failed to do so. Globally carbon pricing has seen more success, most notably in Europe. In almost all cases, however, prices have remained too low and have been applied with too many exemptions to catalyze action on the scale that advocates of carbon pricing had hoped for (World Bank 2020).

Within the US context, frustration over carbon pricing has generated a growing sense that it is inadequate as a policy to address climate change. This view has been bolstered by the increasing prominence of racial and environmental justice groups within environmental policy-making coalitions. Such groups have expressed skepticism around price-based mechanisms as a means for addressing environmental challenges. At the same time, carbon pricing continues to see wider adoption globally (albeit at levels too low to be sufficiently effective), with firms and trade and industry associations increasingly coming out in support of emissions pricing.

In this shifting context, Oxfam US (OUS) has no formal position on whether carbon pricing is a desirable policy, nor on the specific design any such mechanism should take. Nonetheless, Oxfam has come out in support of a carbon price on a few occasions, which has included advocating for application of a price to the aviation and maritime sectors, and the auction of emissions permits that were expected to manifest among Annex I countries in the wake of the Kyoto Protocol (Gore and Lutes 2011; Coleman 2008). Oxfam has also pointed to progressive carbon pricing as a means to address the inequalities that characterize climate change (Gore 2020).² While it is unlikely that Oxfam will make carbon pricing a primary advocacy priority going forward, it is more than possible that questions over carbon pricing will continue to loom large within climate change policy making. Other actors may well seek out Oxfam's support on whether to oppose or support specific pricing mechanisms, and whether to give input or push back on the specifics of their design. Further, Oxfam is likely to

² Specifically, that wealthy groups drive the majority of emissions, while low-income groups experience the greatest harms from the impacts of climate change.

continue to point to carbon pricing as one among many possible policy solutions to the climate crisis.

This report is written with the intention of supporting reflection on these questions so as to aid Oxfam in invoking carbon pricing in as strategic a manner as possible. The report is not intended to offer a novel contribution in the field of carbon pricing but rather is a review of prominent literature, focusing on questions that are of particular salience to Oxfam, e.g., what is carbon pricing's effectiveness in reducing emissions, what are its impacts on inequality, how does the design of a carbon price shape bureaucratic complexity, what are the political economic considerations for a price, etc.

The report proceeds as follows:

- Section 1 introduces concept of carbon pricing, as well as its theoretical attractions;
- Section 2 describes the similarities and differences between placing a tax on carbon and placing a cap on carbon (the two prominent means for placing a price on CO₂), as well as the notion of hybrid approaches;
- Section 3 describes two major design features of a carbon price: how to set the price and what to do with the revenues;
- Section 4 describes the status of carbon pricing globally, as well as the top-line findings from a review of the empirical literature (a discussion of the reviewed literature is in Annex B) and the extent to which it validates the theory laid out in the prior sections;
- Section 5 raises the arguments that have been made against carbon pricing and offers reflections on them;
- Section 6 discusses the design options for improving the political acceptability of carbon pricing and the current political economy surrounding carbon pricing in the US.

The paper contains three annexes. The first describes the details of how auctions might be set up under an emissions cap. The second provides a more detailed account of the empirical literature on carbon pricing. The third addresses concerns that are supplemental to carbon pricing, pertaining to the international trade in carbon credits and offsets.

The report is written with the intention of being read in order, and concepts are built upon throughout. Nonetheless, for readers familiar with the core concepts and evidence, it should be possible to skip around the report to areas of particular interest.

Note on terminology:

This work refers frequently a number of different terms: “carbon pricing,” “emission pricing,” “carbon tax,” “carbon cap,” “emissions trading,” and “carbon markets.” These terms should increasingly make sense as the reader makes their way through the report; in summary, however:

- “Emissions pricing” and “carbon pricing” are used interchangeably to refer to the generic price-based approaches (also referred to as market-based approaches in the literature) to costing the externalities associated with a variety of emissions or specifically CO₂;
- “carbon taxes” and “carbon caps” refer to the two specific mechanisms for achieving a carbon price. Notably, where the creation of a carbon cap also involves the trade in permits, the term is used interchangeably with “emissions trading” and “cap and trade;”
- finally, “carbon markets” refers to markets for CO₂ that are made possible by the commodification and abstraction of CO₂. Carbon markets can include both the market for carbon credits and offsets, and the market for emissions permits under an emissions trading system. As will be explained below, despite having the same name, the creation of a market for emissions permits does not necessitate the creation of a market for offsets. For the purposes of this report and in order to limit confusion, carbon markets will be used to refer to the creation of a market for carbon credits and offsets.

INTRODUCING CARBON PRICING

KEY MESSAGES

- Carbon pricing conceives of climate change as a market failure, with the policy approach focused on correcting that failure.
- Carbon taxes address this market failure by internalizing the costs of emissions.
- Carbon caps (and the allocation of this cap into permits) addresses this market failure by creating use rights to the commons.
- The primary theoretical benefit of carbon pricing over other climate policies is its capacity to identify the least-cost approach to reducing emissions.

The imperative to place a price on CO₂ stems from conceptions of climate change as a market failure, framed in terms of a problem of the “commons.” In this conception, the climate’s ability to safely store CO₂ is the commons (which is shared by everyone). When people consume goods and services, and emit CO₂ as a result, they reap all the benefits of their consumption while the cost of the resulting emissions are distributed among everyone in the form of climate change impacts. As a result, the climate’s ability to safely store CO₂ (a concept known as the “carbon budget”³) is undervalued and overexploited, driving dangerous climate change (Stavins 2020). The idea that someone’s actions drive impacts that are not borne solely by them but also by society is termed an “externality” in economics. Externalities are broken down based on whether the results of an individual’s behavior are beneficial for society (known as “positive externalities”) or whether they are a cost to society (known as “negative externalities”). Climate change is therefore understood as a “negative externality,” as an individual’s consumption decisions impose costs on the rest of society in the form of climate impacts.

This conception drives two types of possible responses. The first is to try to correct for people’s incentives by making the full cost to the commons internal to the person making the consumption decision. This response is most simply achieved via the implementation of a tax.⁴ A variety of taxes are common to everyday life, and carbon taxes are no different. An additional fee is placed on

³ The “carbon budget” refers to the quantity of emissions that can take place before atmospheric concentrations of CO₂ reach a point that dangerous climate change becomes a reality.

⁴ Note a tax in this instance refers to a Pigouvian tax, one that is intended to correct for undesirable behavior. Not all taxes are Pigouvian taxes. The different types of taxes are discussed in greater detail in the section on revenue use.

consumption/production (depending on how the tax is applied) of every good/service based on the amount of carbon that is embedded in the production of that good/service.

The second approach seeks to solve the problem of the atmosphere as a commons—that is, a good that no individual can be excluded from using⁵—by creating use rights to the atmosphere. Under this approach, actors are required to hold a permit (i.e., a use right) in order to emit CO₂ and must surrender that permit upon doing so. In order to make this approach effective for addressing climate change, the number of permits is limited (or “capped”), thereby limiting the quantity of emissions that is possible. Emissions permits are initially either allocated or sold. Further, in many configurations, they can also be traded after the initial purchase/allocation, giving rise to the notion of “cap and trade.” In instances where permits may be sold and/or traded, the cap causes their price to fluctuate in response to demand. While the use of a carbon cap has come to assume that permits to deplete the cap can be traded, it should be recalled that the issue of climate change can be addressed solely through the creation of an ever-tightening cap; no trade or initial auction of permits is necessary (Boyce 2018). What auctioning and trade do is help to effectively determine the price of these permits, which is important for realizing a core advantage of carbon pricing over other policies: that it allows for identification of the least-cost pathway to emissions reduction (discussed below in more detail). For the purposes of this paper, when writing about carbon caps, unless otherwise stated, it will be assumed that permits to deplete the cap are, at least, initially sold (most likely in an auction; see Annex A).

Fundamentally, both a tax and a cap result in an increase in the cost of activities that emit CO₂, because of the need to either pay a tax or purchase a permit.⁶ This cost is understood as the “carbon price.”

Below I will argue that while these two approaches seem quite distinct, once the dominant political concerns are addressed, the outcome is similar, representing a hybrid of the two approaches. Prior to discussing the specific similarities and differences, however, there are a few points that are worth overviewing. First, there is serious criticism of efforts to address climate change by pricing emissions. Second, carbon pricing is not thought to be sufficient, in and of itself, to address climate change. These issues will be discussed in more detail later in

⁵ This refers to the idea of “excludability;” that is, whether a person who does not pay for a good can reasonably be excluded from using it. In the case of the atmosphere, it is impossible to exclude certain people from an atmosphere with low concentrations of CO₂. Thus, no one is willing to pay to create that atmosphere, as they cannot exclude people who do not pay (also known as “free riders”).

⁶ Notably, even if under a cap-and-trade system the emissions permits are given away rather than sold (a process known as “grandfathering”), they create an incentive to reduce emissions among recipients of the permits. The recipients will be incentivized to reduce their emissions whenever doing so costs less than the value of the permits, and then to sell the permits. This incentive, of course, does not hold in the case of non-tradeable permits. This issue is discussed more fully in Box 2 on grandfathering.

the report. For now, this report turns to a discussion of the presumed benefits of pricing CO₂.

THE THEORETICAL BENEFITS OF CARBON PRICING (OVER OTHER EMISSION REDUCTION POLICIES)

Compared to other efforts to address climate change, the fundamental attraction of placing a price on CO₂ is that one leverages market forces to determine the least-cost pathway for reducing emissions. For this reason, efforts to price CO₂ are known as “price-based approaches” (also termed “market-based approaches” in the literature). The logic and assumptions run as follows. Buyers want to minimize their costs, and sellers want to maximize their profits. Putting a price on CO₂ increases the cost of using it, causing buyers to want less of it, meaning sellers will try to use less of it. The advantage of a price-based mechanism lies in the fact that the exact means by which CO₂ reductions are achieved is left to the sellers. Leaving the exact method to the sellers is argued to be advantageous because carbon is embedded in multiple ways across multiple production processes throughout the economy. As a result, there are lots of ways in which the emissions involved in producing a good or service could be reduced. For different goods and services, there will be different pathways to finding the cheapest means to do so. Take a motorcar, for example. CO₂ emissions are embedded, *inter alia*, in: the mining of the minerals that make the vehicle; the processing of the metals used in the vehicle; the factories that build the car; the logistics operations that ship different parts of the car around the world; and the burning of gasoline during the car’s operation. For one car manufacturer, the cheapest way to reduce its emissions might be to improve its shipping logistics so that less fuel is burned in assembling the car. For another manufacturer, the cheapest option might be to use materials with a lower carbon footprint in the car’s manufacture. For another, the most cost-effective pathway might be to invest in R&D to reduce the vehicle’s emissions while in use. The use of a carbon price leaves it to the manufacturer to find the cheapest way to reduce its emissions, as the manufacturer seeks to keep its costs to a minimum so that it can sell its cars at the most competitive price.

Price-based approaches are in contrast to “regulatory and standard-setting approaches” (also termed rather unflatteringly in the literature, “command and control” approaches). Regulatory and standard-setting approaches seek to limit emissions by mandating specific standards; for example, requiring new buildings to achieve certain insulation standards, requiring cars to achieve a certain level of fuel efficiency, or outlawing the use of certain power-generation technologies. The argument by proponents of a carbon price is that, given the huge variety of

ways in which carbon is emitted in the economy, a centralized regulatory approach could never pick the cheapest way to reduce costs (Boyce 2018; Carattini, Carvalho, and Fankhauser 2017; CPLC 2016; Stavins 2020; Goulder and Schein 2013). See Box 1 below for details on how cost should be conceived. Given the unprecedented scale of systems change required to tackle climate change (IPCC 2018), and the resultant scale of the costs involved, realizing the least-cost pathway for emissions reductions is thought to be of enormous importance.⁷ Further, tackling the least-cost abatement⁸ pathways first allows additional resources to be mobilized to drive change on more expensive pathways. It should be noted here that the same concerns about the cost of regulations and standards apply to subsidies. While subsidies create new incentives that the market can respond to in the same way that market mechanisms do, the selection of what gets subsidized requires the picking of winning technologies. Again, the argument is that a centralized approach is unlikely to be able to pick which technologies should receive subsidies to achieve the lowest overall cost for the transition to a low-carbon society.

Box 1: The notion of cost

Because the major advantage of price-based approaches is the capacity to minimize costs, it is worth briefly stating that, in economic terms, this notion of cost really means “opportunity cost.” The idea here is that every dollar spent on addressing climate change reduces our capacity to spend money on something else. Least-cost approaches to addressing climate change are therefore motivated by limiting the amount we must give up as a result of efforts to address climate change. This idea is a complex one, and it can be useful to concretize it. Forgoing costs at the individual level might mean having to spend less on holiday travel as we have to spend more on the energy needed to heat our homes. At the level of the government, it might mean having to spend less on roads because more is spent on retrofitting houses so they use less fossil fuels to heat them. In using these examples, it is important to note their limitations. First, opportunity costs are not equal for everyone. Having to give up leisure travel in order to pay your energy bills is quite different from having to skip meals to do so. Likewise, less government money being made available for national sports teams has different implications compared to less money being available for spending on healthcare. Some of these issues regarding the potential regressivity of carbon pricing will be discussed in more detail below. Second, household spending and national government spending are very different things. While a complete discussion of national debt, monetary policy, and inflation are beyond the scope of this box, and while (to use the above example) a dollar spent on building retrofits does not, in all cases, equate to foregone dollars of expenditure on roads, eventually total national expenditure matters. In this respect, more spending on addressing climate change involves, at some point, less spending on other things. This foregone opportunity to have other things reflects costs. Given the scale of change involved in

⁷ Though it is debatable whether finding the least-cost pathway is the most important consideration for Oxfam.

⁸ CO₂ abatement costs refer to the cost to firms of reducing emissions.

addressing climate change, and the resultant forgoing of other well-being-enhancing expenditures, it is thought to be important to seek to minimize these costs. Hence the argument for carbon pricing as a cost-minimizing approach.

In addition to being least cost, price-based approaches are also thought to be capable of avoiding the phenomenon of “rebound effects.” Rebound effects occur when the application of standards that reduce costs results in more of the good/service being consumed as the costs of doing so have been reduced, thereby offsetting the efficiency gains. For example, vehicle efficiency standards reduce the cost of driving by reducing the amount of fuel a car uses. Under a rebound effect, people end up driving more, because the cost of doing so is reduced. Under an emissions cap, any rebound effects do not affect the overall reduction in emissions that is dictated by the cap. A similar argument can be made for a tax, as any efficiency gains that result from the tax serve to make the good/service more competitive with alternatives (Boyce 2018). While some regulatory approaches can avoid rebound effects (for example, banning the sale of internal combustion engines), others (notably efficiency requirements) run the risk of creating them. Pricing mechanisms simply avoid this risk altogether.

Further, both price-based approaches mentioned here have the scope to raise revenues (the issue of revenue use will be discussed in more detail below). These revenues can be used to address a number of issues. Most notably for Oxfam’s purposes, these include: i) addressing other market failures impeding action on climate change; ii) overcoming the potentially regressive impacts of putting a price on carbon (Boyce 2018; Stavins 2020; Goulder and Schein 2013; CPLC 2016); or iii) funding climate adaptation in low-income countries. Since regulatory approaches lack the ability to raise revenues, any costs of those regulations that get passed on to the consumer can create regressive impacts that may be difficult to address. Further regulatory approaches offer no scope for using the revenues to address other costs entailed in addressing climate change.

Finally, while subsidies can be effective in addressing market failures, a disadvantage of these approaches is that they tend to apply more heavily to new infrastructure. Since a lot of carbon-intensive infrastructure has long lifecycles (± 40 years), a sole focus on subsidies could overlook substantial carbon emissions. Pricing emissions avoids this problem, as the impacts are felt within existing infrastructure through the increased price of fuel inputs (CPLC 2016).

Prior to discussing the specific similarities and differences between carbon taxes and cap and trade, several further generic points about both mechanisms are worth mentioning. First, while this paper is concerned with pricing CO₂, the approaches discussed here need not be limited to that gas. Other greenhouse gasses (GHGs) can be similarly priced (though some attention needs to be paid to their different atmospheric lifetimes (Stiglitz et al. 2017; Goulder and Schein 2013)). Second, numerous GHGs have social costs in addition to their climate

change impacts. For example, burning coal not only produces CO₂; it also produces particulates and chemicals that result in significant health problems. In such cases, there can be additional value in placing a higher price on emissions to reflect these costs and capture the co-benefits (that is, benefits from reducing harmful non-CO₂ pollutants associated with CO₂ emissions) of reducing CO₂ emissions. Notably, however, the different behavior of local vs. global pollutants can introduce some complications in pricing design (Fowlie, Walker, and Wooley 2020; Cushing et al. 2018). This issue is discussed more fully in the sections dealing with regressivity in carbon pricing below. Finally, while carbon pricing offers a potentially important means for tackling climate change, the failure to cost emissions is not the only market failure impeding the transition to a low-carbon economy. If market mechanisms are to deliver an efficient transition, there are real complimentary policies that are needed in addition to carbon pricing (Carattini, Carvalho, and Fankhauser 2017; Goulder and Schein 2013; Stavins 2020). All these issues will be discussed in greater detail below.

CARBON TAXES AND CARBON CAPS

KEY MESSAGES

- Despite the array of similarities and differences between carbon taxes and carbon caps, the one major difference between the two approaches—regarding uncertainty around emissions in the case of a tax and uncertainty around price in the case of a cap—is likely to result in policies that produce a hybrid tax and cap.
- As a result, it is likely that the specific design choices for the hybrid outcome will matter more for the effectiveness and fairness of any carbon pricing mechanism than whether a tax or cap is chosen as the policy mechanism.

This section of the report introduces the workings of carbon taxes and carbon caps through a discussion of their similarities and differences. The central thrust of this section is to argue that while the two mechanisms have some differences, concerns about their one primary difference—pertaining to uncertainty about prices in the case of a cap and uncertainty about emissions in the case of a tax—are likely to drive policy, which results in a hybrid of the two approaches. In this respect, the details of policy design around any hybrid pricing mechanism are expected to be more important than whether it is a carbon tax or carbon cap that underlies emissions pricing. It should be noted that the following section of the report draws heavily on the analysis by Stavins (2020), which is supplemented with other literature encountered as part of this review.

SIMILARITIES

There are a number of important similarities between emissions trading and taxation. These include: i) ability to achieve least costs; ii) ability to reduce emissions; iii) ability to generate revenues; iv) considerations about point of compliance; v) distributional impacts; vi) ability to incorporate exemptions; vii) ability to recirculate revenues; viii) need for complimentary policies; and ix) ease of harmonization with other pricing regimes.

Achieving least-cost reductions

Both a cap and a tax have the same ability to achieve the least-cost advantages of a price-based approach (Stavins 2020; Weitzman 2014). In both cases, individual firms decide whether to pay the carbon price (that is, pay the tax or buy a permit) by comparing it to the cost of reducing their carbon emissions. When it is cheaper to cut emissions, they will prefer to do so. In both cases, the carbon price is incorporated into the cost of doing business and hence in prices paid by final consumers. As such, the least-cost pathway is determined on a firm-by-firm basis, based on their specific operating costs (Boyce 2018). Both processes are therefore equally capable of determining the least-cost investments.

Reducing emissions

Both taxes and a cap are thought to be equally effective in reducing emissions (Goulder and Schein 2013). That said, the mechanism for driving emissions reduction is different in each case. For taxes, the tax rate is determinant, while for a cap, the stringency of the cap is determinant. This difference has implications for how uncertainty is manifested differently across the two mechanisms (see section on differences below). However, if the cap is set such that the cost of purchasing permits is equivalent level of the tax, or vice versa,⁹ the impact on price will be the same, and thus the imperative to reduce emissions will be the same (Stavins 2020; Boyce 2018).

Revenues

Taxes and caps have the same capacity to raise revenues. However, the mechanism by which revenues are raised differs across the mechanisms. Under taxes, fees are simply paid based on CO₂ emissions. Under a cap, revenues come from the initial sale of the permits. Notably, permits need not be sold. They can be given away (a process known as “grandfathering”—when free permits are allocated among firms by a formula based on past emissions. See Box 2 for more details). If permits can subsequently be traded (as in a “cap-and-trade” approach), grandfathering simply confers the value of the permit to the firm that receives it (Goulder and Schein 2013; Stavins 2020; Boyce 2018; Aldy 2017; Cramton and Kerr 2002). If, however, the state sells those permits in a way that effectively discovers their real value, usually through an auction (see Annex A), then their sale is as effective as a tax when it comes to raising revenues for the state (assuming the approaches are similarly designed such that the tax rate is

⁹ Note that the simplicity of this statement belies the complexity of achieving such equivalence. This explanation is not intended to undermine the complexity of making caps and taxes equivalent, it is to suggest that, if ambition is similar, both mechanisms have the same ability to reduce emissions.

equivalent to the cap in its capacity to reduce emissions) (Goulder and Schein 2013; Stavins 2020).

Box 2: Grandfathering

Grandfathering is applicable to emissions pricing systems that operate under a cap and refers to the process of giving away permits, rather than having them be purchased, most likely through an auction (see Annex A). The initial logic behind grandfathering was to insulate certain industries from having to pay higher costs for their inputs, which would render them vulnerable to competition from industries located outside the jurisdiction in which the carbon price was applied. These industries could sell goods and services more cheaply as a result of not having to pay more for carbon-intensive inputs. The grandfathering of permits was thought necessary both to protect the competitiveness of local industries and to limit the scope for emissions to simply move out of the regulated jurisdiction and into unregulated ones (a process known as “leakage”).

Notably, however, the process of grandfathering has faced significant criticism and has largely been eschewed in carbon pricing approaches involving a cap. The reason is that at low prices, and in sectors facing little competition (e.g., electricity markets), concerns over competition appear overblown (see sections below on the state of carbon pricing and the empirics of carbon pricing. More importantly, under a system of tradeable permits, grandfathering simply represents a windfall gain for the company receiving the permits. It might be assumed that grandfathering will prevent cost increases for the final consumer, as the retailer has not had to pay for the permits. However, this assumption is incorrect. Once permits have value,¹⁰ giving them away simply confers this value on to the recipients of the permit. The recipients of the permits have an incentive to reduce their own emissions and sell the permits at the market price, even if they didn’t have to buy them. In this respect, they are incentivized to undertake emissions reductions to the value of the permit, and then sell the permit, profiting from the sale, while also passing the increased cost of permits on to the consumer (Goulder and Schein 2013; Cramton and Kerr 2002). The degree to which this process happens in practice is discussed in the section on empirics. The alternative to grandfathering is either to auction permits (see Annex A for details) or to undertake output-based allocation (OBA), under which an emissions intensity standard (i.e., in tons of CO₂ per unit of output) is established for firms/sectors that would qualify for grandfathering. Firms are then allocated permits equivalent to what they would have needed had they met the standard. Firms must purchase permits for any amount by which they exceed the standard. OBA has the advantage of incentivizing emissions reductions without allowing for windfalls and limits the scope for leakage. However, the process of standard setting creates another potential loophole for weakening ambition on emissions reduction.

¹⁰ Which will be determined by the level of the cap, the state of demand for carbon-based goods and services, and the economy-wide abatement costs.

Point of compliance

Whether capping carbon or taxing it, both approaches have equal flexibility as to where in the economy the permits are required or where taxes must be applied. These places in the economy are referred to as the “point of compliance” and are generally broken down into upstream, midstream, and downstream. “Upstream” refers to the point at which carbon enters the economy, e.g., at refineries or import facilities. “Midstream” refers to the point at which large quantities of CO₂ are emitted in generating inputs to the economy, e.g., in fossil fuel power stations. “Downstream” refers to the point at which the final good or service is consumed, e.g., individuals emitting CO₂ by burning of fuel in their cars or homes.

Moving the point of compliance upstream has the advantage of significantly reducing the administrative costs of the scheme, as one only need ensure compliance across hundreds of large upstream facilities, rather than millions of downstream tailpipes and chimneys, with resultant issues for emissions accounting. On the downside, moving the point of compliance upstream limits the scope for creating specific exemptions (which might be important for addressing political economy concerns), though these could be addressed via rebates to specific entities or sectors if needed. An upstream price also overlooks the possibility for generating transparent records of carbon emissions by end users, which could provide a potentially useful product for advocacy/accountability on emissions reductions. Notably, the advantages of the upstream application of a price might be limited to addressing GHGs with major point sources (e.g., CO₂) and might be less useful for GHGs for which emissions are more distributed, such as agricultural emissions of methane. Regardless of the benefits of upstream vs. downstream, the considerations are equally applicable across both pricing mechanisms (Stavins 2020).

A quick aside on an upstream price. The logic behind the application of an upstream price is that firms paying a carbon price will pass that cost on to other firms in the form of higher prices for their product. This passing on of the cost continues until the good reaches the consumer (a phenomenon known as “cost passthrough” in the literature). It has been noted that cost passthrough has been erroneously understood as a bug in carbon pricing initiatives when, in fact, it is a feature. To this end, it is worth stating clearly that it is cost passthrough that creates the incentive to move away from fossil-intensive goods and services and move towards goods that contain less embedded CO₂, as sellers compete for buyers based on price. Cost passthrough drives the system to identify the least-cost pathway to reducing emissions (Boyce 2018). The degree to which cost passthrough takes place or not is discussed in Annex B on empirics.

Distributional impacts

The distributional effects of carbon pricing take three dominant forms: i) direct economic impacts; ii) environmental impacts; and iii) indirect economic impacts. Direct economic impacts refers to the ways in which changes in price directly affect the income of households and are further broken down into a) use-side effects and b) source-side effects. Use-side effects refers to the increased cost of using carbon-intensive goods and services that results from the implementation of a carbon price. Source-side effects refers to the impact of a carbon price on sources of household income (see Figure 1). The overall progressivity or regressivity of the direct economic impacts of a carbon price results from the net of use- and source-side effects.

Starting with use-side effects, because low-income households spend a greater portion of their income on a number of carbon-intensive goods and services (such as energy) than do wealthy households, use-side effects are anticipated to be highly regressive (Fremstad and Paul 2019; Goulder et al. 2019).

Source-side effects (effects on household's source of income) derive from three primary sources:

1. What is done with the revenues from the price?
2. How does a carbon price interact with other government transfers?
3. How does a carbon price affect the different factors of production in the economy?

The distributional impacts of both 1) and 2) depend on particular policy choices; for example, how the revenues generated by the carbon price are used and distributed, and what other government policies look like such that the carbon price might interact with them. In terms of the evidence, regarding a) the use of revenues, the use of a uniform dividend (i.e., the equal distribution of all revenues back to all households, equally) is thought to be progressive, as wealthy households are anticipated to pay more in carbon prices due to the fact that they consume more carbon-intensive goods than low-income households (which is true even though low-income households tend to spend a greater proportion of their income on energy, making use-side effects regressive). Further, the literature generally agrees that policy approaches that target revenues at low-income households will tend to make the overall direct impacts of a carbon price substantially progressive. On the other hand, Fremstad and Paul (2019) suggest that if revenues from carbon prices are used to reduce other taxes in the economy (for example, income or corporate taxes), the potential economic gains from any resulting increase in economic activity will not be sufficiently realized by low-income households to offset the likely regressive use-side effects. See section on revenue use, below, for more details.

Regarding 2) how a carbon price interacts with other government policies, Goulder et al. (2019) estimate that, assuming other government transfers remain indexed against the consumer price index (CPI)¹¹ (as they currently are in the US), then the impact of a carbon price—which will increase the CPI—will increase the transfers received by households. Since households are differentially reliant on government transfers for their income (with low-income households being much more reliant), this source-side impact is anticipated to be substantially progressive. Of course, if the policy divorces transfers from the increased CPI, this impact will disappear (Goulder et al. 2019).

Finally, regarding 3) the interaction of carbon pricing with the structural features of the economy, if, for example, new capital investments are more carbon intensive than retrofitting old assets, then the implementation of a carbon price will reduce demand for (and therefore returns to) capital, while returns to labor will increase. Households that rely on returns to capital as a source of income (generally the case among wealthier households) will see greater reductions in welfare than those that rely exclusively on labor for their income, thus generating differential distributions of source-side impacts. Efforts to model the scale of this impact have not shown it to be sufficiently large, by themselves, to counter the regressive impact of use-side effects (Goulder et al. 2019). Such findings echo the results of Fremstad and Paul (2019), which indicate that any increase in economic activity that might result from using the revenues generated by a carbon price to reduce tax payments will not trickle down to low-income households in sufficient measure to offset the regressive impact of use-side effects.

¹¹ The consumer price index (CPI) reflects the price consumers pay for goods and services, based on a basket of goods thought common across households. It is intended to provide an indicator of the changing cost of living.

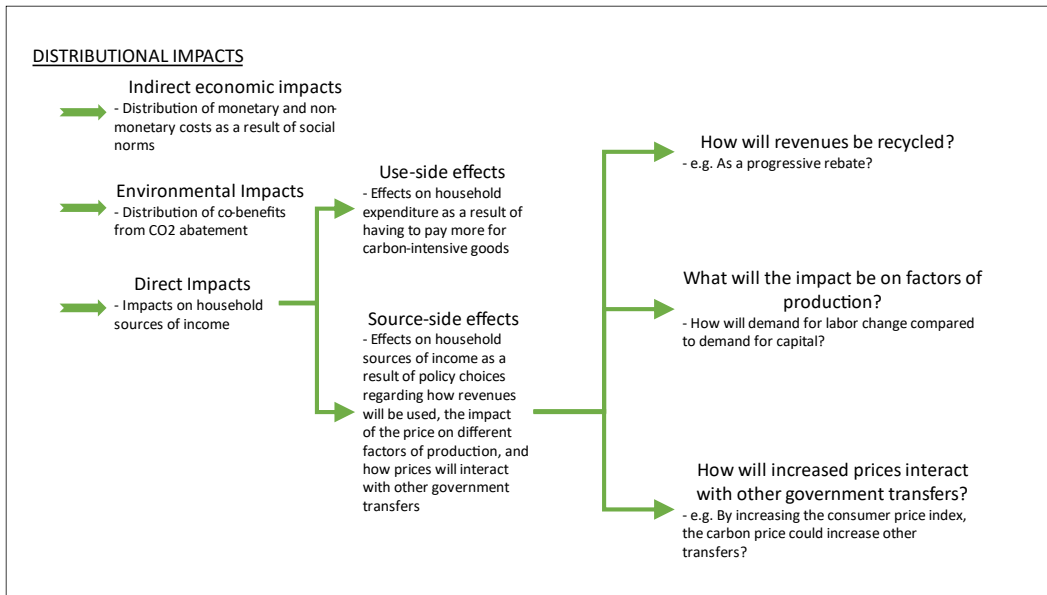


Figure 1. Breaking down types of distributional impacts and their drivers.
Source: Author.

The second distributional concern pertains to the distribution of environmental impacts through the distributions of abatement costs. Carbon pricing will drive changes first in the sectors with the lowest abatement costs. If it turns out that industries with high abatement costs are clustered in geographies inhabited by low-income groups, or vice versa, then the implementation of a carbon price will drive emissions reductions in high-income geographies before low-income geographies (or vice versa). If those facilities with high abatement costs also cause harmful local pollution, then the closing of polluting facilities in high-income areas would be driving regressive impacts as high-income areas see reduced pollution (Fowlie, Walker, and Wooley 2020) (or vice versa, in which case pricing would be progressive). This issue is of primary concern among advocates concerned with environmental racism and will be discussed in greater detail in the section that discusses arguments against carbon pricing.

The third distributional effect pertains to indirect economic impacts that result from interactions between the specific policy design and social norms (Chalifour 2010). For example, since, in many contexts, women bear a greater responsibility for care work and have fewer financial resources available to them, they are likely to have less scope to amend their behavior to respond to a price on carbon. Social norms that cause women to bear a disproportionate responsibility for care duties and which limit their financial autonomy have been identified as ways in which women could be disproportionately exposed to a carbon price. The time pressures care duties create may limit women's scope for engaging in carbon-free modes of transport such as walking or cycling, while constrained financial autonomy may limit scope for investing in low-carbon transport technologies. Social norms might cause women to have less scope to

amend their behavior such that they don't simply have to absorb carbon prices. This specific case of women is thought to be applicable to all social groups who have less choice in undertaking actions to mitigate their own emissions and who are expected to be disproportionately exposed to increased prices (Chalifour 2010).

All of these distributional impacts are extremely important and will be addressed in more detail in the sections discussing how revenues should be used and reflecting on the arguments against carbon pricing. For now, it is simply worth noting that a) these arguments are equally applicable to both emissions trading and carbon taxes and b) they can be addressed by specific policy design choices, which can be used to make carbon pricing highly progressive (Fremstad and Paul 2019; Stavins 2020; Goulder et al. 2019).

Ability to incorporate exemptions

The issue of exemptions, just mentioned, is also of concern regarding potential impacts on competitiveness. Here the concern is that placing a price on carbon emissions increases the cost to manufacturers within the jurisdiction implementing the price. Increased costs lessen the ability of those manufacturers to compete with goods and services produced by manufacturers from a jurisdiction where pricing is not implemented. Carbon pricing therefore might scare capital out of jurisdictions, risking capital flight, job losses, technology transfers, and undermining of the tax base. Such an outcome would also undermine the aims of the carbon price, as emissions would "leak" to the jurisdiction where there is no price, and where economic activity (and CO₂ emissions) would increase (Aldy 2017; Stavins 2020). Such issues are thought to be particularly acute in sectors where market competition and scope for imports is high, and less of an issue in monopoly markets (e.g., power generation). This problem is a potentially serious one that will be discussed in more detail in the section on empirics.

In terms of the ability of the two pricing mechanisms to confront this issue, however, they are equally capable, either through tax or permit exemptions as described above or through the implementation of a border adjustment (Goulder and Schein 2013; Stavins 2020). Box 3 provides a longer discussion of the legality of a border adjustment in the context of the World Trade Organization (WTO), but it is worth noting here that there is some evidence to suggest border adjustments are a more cost-effective solution than some form of exemption, with cost effectiveness increasing as climate action becomes more ambitious (Droege and Fischer 2020). A final note on border adjustments is that some authors have pointed out that least-developed or low-income countries could be exempted from any border adjustment-related import tariffs to align any carbon price with United Nations Framework Convention on Climate Change (UNFCCC) principles of common but differentiated responsibilities. This exemption is thought to be

important for issues of equity and to have only limited impacts on leakage, as very few low-income countries export energy-intensive, trade-exposed goods. A further option would be to impose the tariff and then return the revenues raised by such tariffs back to low-income countries (Droege and Fischer 2020).¹²

One further possibility for addressing competitiveness is to change the point of compliance, moving it downstream, so that prices are incorporated into the good/service at the point of consumption. While this strategy increases administrative complexity, it is a strategy that is, again, equally applicable to both pricing mechanisms (Goulder and Schein 2013).

Exemptions might also be sought for reasons of political economy. If well-organized special interests in certain industries stand to potentially derail efforts at a carbon price, these can be addressed by exempting specific industries. As above, opportunities for exemption are equal across both mechanisms. That said, the cap-and-trade mechanism creates the possibility for generating windfalls through the giving away of permits. In this way, particular special interest groups might be won over into alliances for a carbon price through the use of grandfathering, an option that is not available with a tax. Because this difference pertains to political economy considerations rather than exemptions, regardless of it being a difference, I leave it as a similarity here and will address it more completely under the discussion on political economy.

Box 3: Border adjustments and the WTO

While a detailed account of border adjustments and their legality¹³ within the WTO is beyond the scope of this report, it is worth noting that a border adjustment is, in theory, not believed to contradict the terms of the General Agreement on Trade and Tariffs (GATT), which governs such issues. The basis for this assertion¹⁴ is, in brief, that:

- First, countries routinely apply border adjustments to goods on which domestic taxes exist, such as alcohol and tobacco (UNEP and WTO 2009).
- Second, Articles II and III of the GATT allow for the application of charges/tariffs on imported goods so long as the charge is equivalent to the domestic tax and does not arbitrarily discriminate against particular countries or unduly increase the competitiveness of domestic industries.

¹² Though doing so should of course be additional to, and not a substitute for, established commitments on climate finance and development assistance.

¹³ Note the reader should recall that the WTO has no power to compel countries through their courts. Sanction derives from the actions of other members, and thus any violation of WTO rules would be met by a requirement to change those rules, conclude mutually agreed solutions with other countries, or accept suffering equivalent trade retaliation (Pauwelyn and Kleimann 2020).

¹⁴ As articulated by the WTO (in UNEP and WTO 2009) and by a former member of the WTO appellate body (in Hillman 2013).

- Third, Article XX of the GATT allows WTO members to adopt policies that are inconsistent with the GATT but necessary to protect human, animal, or plant life, or that relate to the conservation of exhaustible natural resources. Climate policy clearly does both (UNEP and WTO 2009; Monjon and Quirion 2011; Hillman 2013).

Thus, a well-designed carbon price should be amenable to a rationally implemented border adjustment within the WTO regulations (Droege and Fischer 2020; Pauwelyn and Kleimann 2020). That said, some practical concerns do exist. The first is to ensure the legislation pertaining to a carbon price is articulated such that the stated aims are about addressing climate change. Second, and more challenging, is how to assess the CO₂ intensity of imported goods (which can be difficult due to the challenges of assessing embedded carbon) in a way that is immune to arguments that the border adjustment is imposing costs that are in excess of the domestic price. The general proposed solution is to calculate emissions for imported goods, based on benchmarks around either the “best available technology” or the “predominant method of production,” with importers able to access reduced fees if they can demonstrate (with verification) that their production process is less carbon intensive than the standard (Monjon and Quirion 2011; UNEP and WTO 2009).

Regarding exemptions and the means for protecting industries, it should be noted that a border adjustment is thought to be a more effective means to reduce overall emissions than the free allocation of permits under an emissions permitting system (i.e., the other dominant means for addressing competitiveness concerns). A border adjustment ensures that domestic producers cannot access cheaper carbon-intensive imports that are not exposed to a price and further prevents against leakage. Free allowances account for neither of these issues (Monjon and Quirion 2011). These questions of design are equally applicable to both a tax and cap-and-trade approach.

While a tariff can legally be placed on imports so as to make domestically produced goods competitive in the domestic market, export rebates—which would be necessary to ensure manufacturers in a region with a carbon price can remain competitive in terms of their exports to regions without carbon pricing—are considered legally challenging, as they would fall under the WTO restriction on “prohibited subsidies” (Droege and Fischer 2020; Pauwelyn and Kleimann 2020). Further, unlike tariffs that fall under Article XX of the GATT, which justifies exceptions on environmental grounds, subsidies have no such mechanism (Droege and Fischer 2020). Finally, such rebates might undermine climate ambition by encouraging firms to simply focus on exporting so as to circumvent the costs of carbon abatement (Pauwelyn and Kleimann 2020).

Ability to recirculate revenues

In theory, the question of how revenues are used, and their capacity to address any regressive impacts resulting from the implementation of a price/tax, is divorced from the mechanism by which a price is placed on emissions. In this way, there is no difference between the two pricing mechanisms. Questions of how revenues should be used are discussed in a separate section (also see the

above section on distributional impacts). At the same time, it should be noted that one author has pointed out how different bureaucratic processes surrounding the legislative processes for raising and spending taxes vs. using newly generated permit revenues might be different under different legal contexts so as to limit the ways revenues can be spent (Stavins 2020). This issue will be discussed more fully in the section on the political economy of carbon pricing within the US.

Need for additional complimentary policies

Neither carbon taxes nor cap-and-trade approaches are sufficient by themselves to achieve the market conditions necessary to drive an efficient transition to a low-carbon economy. Neither approach is sufficient even if the pricing mechanism is perfectly designed, i.e., to include all the relevant sectors of the economy and at a suitably high price/stringent cap to create the correct incentives (Ball 2018; Aldy 2017). This is because the undervaluing of CO₂ emissions is not the only market failure driving climate change. A host of other market failures also drive underinvestment, including the need for public goods, like public transport and R&D, both of which experience substantial positive externalities and therefore see underinvestment of private capital. Similarly, network challenges thwart some technological transitions. For example, a lack of electric vehicle-charging infrastructure constrains the purchase of electric vehicles, and, vice versa, the lack of electric vehicles limits demand for electric vehicle-charging infrastructure. In this way, additional policy and complimentary investments will be needed in addition to carbon pricing. This need applies equally to both pricing mechanisms (Goulder and Schein 2013; Stavins 2020; Carattini, Carvalho, and Fankhauser 2017; Ball 2018).

While complimentary policies will be needed regardless of the pricing mechanism used, it is important to distinguish between genuinely complimentary policies, which address market failures that carbon pricing overlooks, from other regulatory approaches to reducing CO₂ emissions, which effectively compete with carbon pricing to reduce emissions. Competing policies behave very differently under the two mechanisms. Because this difference is a major one between the two approaches, it will be discussed more fully in the section on differences below. For now, it is worth briefly noting that competing policies remain effective (if not more expensive) under carbon taxes but have no effect under a cap-and-trade-scheme, simply serving to redistribute emissions to other sectors (Stavins 2020; Boyce 2018).

Harmonization with other regimes

In addition to considering interaction with complimentary policies, it is also important to consider whether there are differences in the ease of linking up different pricing mechanisms across different jurisdictions. There are good reasons to want to link pricing schemes up together, as doing so: i) increases the

scope for finding lower abatement costs, reducing the overall cost of the transition (Stavins 2020; Goulder and Schein 2013; Aldy 2017; Mehling, Metcalf, and Stavins 2018); ii) diversifies demand, which reduces price volatility (in the case of cap and trade); iii) shows political momentum, potentially making further uptake easier; iv) provides administrative economies of scale; v) results in reduced equity challenges across countries (Stavins 2020; Mehling, Metcalf, and Stavins 2018); and vi) reduces the need for border adjustments. Such gains notwithstanding, it should be remembered that linking regimes has distributional impacts, as it is likely to relocate where emissions reductions take place and thereby where co-benefits of emissions reduction are realized (in the case of international linkages, these reductions tend to skew towards low-income countries where abatement costs are anticipated to be lower) (Mehling, Metcalf, and Stavins 2018). Despite these advantages, in theoretical terms neither approach to carbon pricing is significantly easier to link with other regimes. It is worth noting, however, that in practice there have been multiple instances of linking between emissions trading systems and entire frameworks have been developed to support such linkages. There is no comparable level of activity on carbon taxes, likely indicating the political challenge involved in harmonizing taxes. Thus, while these are theoretical similarities, the practicalities appear quite distinct. Overall, the more similar the two regimes are (in terms of coverage, cap size/tax rate, point of compliance, etc.), the easier they are to link up (Mehling, Metcalf, and Stavins 2018). It is theoretically possible to link up different pricing mechanisms (an emissions trading scheme with a tax, for example). However, doing so is likely to be challenging, as rates and caps need to be rendered equivalent (Goulder and Schein 2013). It is notable that linking different pricing mechanisms has never been done in practice (Haites 2020).

DIFFERENCES

Having discussed the principal points of similarity between the two emissions pricing mechanisms, this report now moves to discuss their substantive differences. These include: i) uncertainty; ii) interaction with competing policies; iii) administrative complexity; iv) scope for corruption and manipulation; vi) possibility of transferring wealth to fossil fuel producing countries; and vii) political palatability. The differences are summarized in Table 1 below.

Table 1. Salient differences between carbon taxes and emissions trading

Element	Tax	Emissions trading (under a cap and allowing for trade)
Uncertainty	Price is known, emissions are uncertain	Emissions are known, price is uncertain
Competing policies	Competing policies raise costs	Effect of competing policies is reduced to zero
Administrative complexity	Tax is less complex (though in reality this might not be the case)	Emissions trading is more complex
Corruption and manipulation	Taxes are less vulnerable to corruption and manipulation, with avoidance the only risk	Emissions trading is more vulnerable due to the possibility of permit theft and market manipulation
Transfer of wealth to fossil fuel-producing countries	Tax creates no possibility of transferring wealth to oil-producing countries	To the extent that coordination around oil and gas supply is possible and fuels are not substitutable, the value of permits is anticipated to flow to fossil fuel producers
Political palatability	Voters thought to be more resistant to the notion of taxes compared to trade—note that not all cap systems require trade in permits.	Potentially greater public resistance to flows of wealth between international corporations as opposed to between corporations and their governments

Uncertainty

The most fundamental difference between taxes and the use of an emissions cap pertains to the locus of uncertainty (Goulder and Schein 2013; Stavins 2020; Stiglitz et al. 2017). Under a carbon tax, because the level of the tax is set, the price of basic inputs to the economy is well known. What is unknown is the effect the tax will have on emissions. For example, in a time of rapid and large-scale economic growth where demand for energy is high, people might be willing to pay very high prices for energy, and thus emissions might continue to rise despite the implementation of a tax. Further, if in setting the tax, the abatement cost of CO₂ is underestimated, then the impact on emissions could be very limited (Aldy 2017). Under a cap, where permits are purchased, the locus of uncertainty is the opposite. Placing a cap on emissions means that the level of emissions is known. However, because permits are purchased (either at auction or at auction and then through trades), permit prices will vary widely depending on the level of demand in the economy (Goulder and Schein 2013; Boyce 2018). For example, in times of rapid and large-scale economic growth, demand for energy (and therefore permits) will be high, resulting in high prices for goods and services containing large amounts of embedded carbon. In summary, under a carbon tax, prices are known, but emissions are variable, and under a cap, emissions are known but permit prices are variable (Stavins 2020; Goulder and Schein 2013).

Some of the price volatility resulting from a cap can be dealt with via the introduction of permit banking, which allows permits bought in one period to be used in another. Permit banking creates an incentive to purchase permits when the price is low (thereby increasing their price) and sell them when the price is

high (thereby reducing their price), with the overall effect being a smoothing of the permit prices. Permit banking effectively shifts the system towards addressing cumulative emissions, rather than emissions within a specific period (Aldy 2017; Stiglitz et al. 2017; Cramton and Kerr 2002; Stavins 2020; Goulder and Schein 2013). The other means for addressing uncertainties in the two mechanisms stems from effectively turning them into hybrid approaches, mixing elements of a cap and a tax, through price ceilings and/or floors and benchmarked tax adjustments. These approaches will be discussed in more detail under the subsequent section on hybrid approaches.

Interaction with competing policies

It was mentioned above that both pricing mechanisms are identical with respect to their need for complementary policies to address market failures that are in addition to the market failure that causes the carbon budget to be undervalued. It was also pointed out that the two mechanisms have very different interactions with policies that compete for emissions reductions. This difference requires greater explanation.

In the case of a tax, competing emissions-reduction mechanisms (e.g., an insulation standard) operate as expected, with the tax simply further increasing the cost of emissions. That said, because the competing mechanism is unlikely to be the least-cost approach (see above), the price of the overall low-carbon transition is increased compared to an approach that simply used a higher tax and used the market to identify the least-cost pathway. On the other hand, under a cap, the interactions are significant, as the effect of the competing mechanism on overall emissions is reduced to zero. The reductions driven by the competing policy simply reduce the demand for emissions permits, thereby reducing their price and thus increasing emissions in some other sector of the economy (Aldy 2017; Stavins 2020).

An example is useful to make the difference clear. First, take the case of a tax. Imagine a standard that requires all motor vehicles to achieve a certain level of efficiency. If the standard is introduced where a tax exists, there is no interaction. The emission reductions achieved by the tax simply adds to the reductions achieved by the fuel efficiency standard (Stavins 2020). That said, in cases where investments in vehicle-efficiency improvements are not the cheapest way to reduce emissions, the overall cost of achieving these emission reductions will be higher than it would have been if a higher tax rate had simply been in place with no efficiency standard.

Now take the case of a cap in which permits must be bought; if a vehicle-efficiency standard is introduced, the two regulations interact. The effect of the efficiency standard is to reduce the demand for permits (because the efficiency standard would reduce emissions), which reduces their price. As a response, firms that would have previously (under the condition of greater demand and

therefore higher prices for permits) abated their emissions, as permit prices were above abatement costs, now simply purchase permits and emit CO₂. By this process, the emissions reductions achieved by the vehicle-efficiency standard get transferred somewhere else in the economy due to the reduction in permit prices such reduced demand entails. The overall effect is that the quantity of emissions remains the same regardless of whether the vehicle efficiency standard had been put in place. The two pricing mechanisms therefore differ quite significantly in terms of their interaction with competing policies.

While this difference is a profound conceptual one, two points are worth keeping in mind. First, while the difference between competing and complimentary policies might seem straightforward, on the basis of whether or not they solve a market failure or advance overall economic efficiency for example, differences can also be more subtle. This subtlety is the result of the fact that the entire theory underpinning carbon pricing relies on assumptions about individual consumers as rational utility maximizers who seek the most diverse array of goods at the lowest cost. This assumption is, of course, only an estimation of actual human behavior, and thus in cases where the theory performs weakly, there is scope for seemingly competing policy to manifest in complimentary ways, in that it advances emissions reductions at a lower overall cost than would have been possible without the intervention. A notable instance is the automotive sector, where demand responds weakly to price, and where people make purchasing decisions about their cars based on a variety of non-price considerations, such as status and identity. In such a context, apparently competing regulatory approaches can play a role in achieving the least-cost transition to a low-carbon economy.

Second, despite the difference between emissions trading and a tax with respect to their interaction with competing and complimentary policies, it is not clear that one should conclude that either mechanism is superior. In the case of cap and trade, the cost of a lack of policy coordination is squandered political capital that was spent in passing regulatory efforts to limit CO₂ but which end up having no effect on overall emissions. For taxes, while the impact on emissions is additive, the cost manifests in terms of an increased abatement cost, as regulatory efforts are extremely unlikely to achieve the lowest-cost pathway for emissions abatement across sectors (Goulder and Schein 2013; Stavins 2020). Both approaches, therefore, must be concerned with their interaction with other policies, with differences pertaining to the nature of the cost: squandered political capital in the case of a cap vs. costs to the overall economy in the case of a tax.

Administrative complexity

It is noted in the literature that the simplest tax will always be simpler than the simplest cap (Stavins 2020). Even in its simplest form, a cap will require an institution to handle the auction and potential trade and exchange of permits,

which is simply unnecessary under a tax (in both cases you have to monitor consumption and collect permits/revenues) (Stavins 2020; Boyce 2018). Although this fundamental difference might seem important at first, Stavins (2020) makes the important point that any eventual tax or cap-and-trade scheme that gets passed is unlikely to be in its simplest form and will probably include a variety of exemptions and allowances. While a tax might seem therefore like the simplest option at first glance, the complexity of any real policy may well be similar across both pricing mechanisms.

Scope for corruption and manipulation

While tax avoidance is a real possibility, it is thought that emissions trading offers greater scope for corruption and requires greater regulatory attention (as a result of greater administrative complexity) (Stavins 2020; Boyce 2018; Stiglitz et al. 2017). This risk for corruption is essentially due to the scope for market manipulation and permit theft, which are in addition to the challenges of permit/tax collection. However, Stavins (2020) points out that for economies with substantial financial services (which also tend to have the largest per capita emissions) these risks should not be unmanageable, thus limiting the degree to which the two approaches differ.

Transfer of wealth to oil-producing nations

Goulder and Schein (2013) point to an important difference between taxes and cap-and-trade approaches, arguing that the latter will result in an effective transfer of wealth to fossil fuel-producing countries. For an account of the formal economic logic, the reader is directed to the original work; however, the intuition runs as follows: assume a world (i) reliant on oil; (ii) where there is only one oil producer; and (iii) there is no substitute for oil. The rest of the world introduces an emissions cap, thereby creating a price for emissions permits. The following happens:

- First, the need for permits increases the effective price of oil, thereby reducing demand for oil;
- second, in the face of reduced demand, the oil producer sees reduced revenues, and reduces supply so as to increase the oil price;
- third, this increase in oil price reduces the demand for permits, lowering their price and increasing the revenues received by the oil-producing state.

The above reflects an effective shifting of the value of the permit to the oil-producing country in the form of a windfall, achieved by limiting supply. This process will continue to adjust until the reduction in supply on the part of the oil producer results in the same effective level of demand for oil as would have happened under the cap. Notably, however, the equivalent value of permits will

accrue to the oil exporter in the form of windfall rents (Goulder and Schein 2013; Boyce 2018).

In the real world, of course, these assumptions don't hold. We have multiple oil producers, and their ability to coordinate around supply is limited. Further, fuels are substitutable to some degree (and will become increasingly so as alternative technologies emerge). As a result, the full value of the cap will not be transferred to oil-producing nations. That said, supply coordination does occur to some extent, and fuels are not perfectly substitutable. Thus some wealth transfer will take place under a cap. No such outcome manifests under an emissions tax (Goulder and Schein 2013).

Political palatability

While issues surrounding the political economy of carbon pricing will be addressed more fully in a later section, it is worth mentioning here that some differences are thought to exist across the two pricing mechanisms. The first is a potential discursive difference, with voters thought to be more resistant to "taxes" than to "trade," so cap and trade might be more palatable (Goulder and Schein 2013). Evidence of this preference was displayed by the effective reframing of the cap-and-trade policy in the US, as "cap and tax" by its opponents (Stavins 2020). Further, it is hypothesized that political support for an emissions-trading scheme will be limited under a multinational cap-and-trade regime compared to a tax regime, as under the former, payments will be between large multinational companies in different countries (as trading takes place) rather than between corporations and their governments. Despite this hypothesis, it should be noted that the EU emissions trading system has not seen effective attacks on the basis that it is driving transfers of wealth between large multi-national firms¹⁵ (Goulder and Schein 2013).

HYBRID APPROACHES

Having discussed the similarities and differences between the two approaches to pricing emissions, this report now turns to a brief discussion of hybrid approaches. Hybrid approaches result from efforts to address the major source of difference across the two mechanisms: price uncertainty in the case of an emissions cap and emissions uncertainty in the case of an emissions tax. Hybrid approaches came about because neither uncertainty is politically palatable (Brooks and Keohane 2020). Volatile prices create stresses for both consumers and firms (which translates into political opposition), undermines R&D spending (Stavins 2020), and constrains entrepreneurial activity in the space (Stiglitz et al. 2017). Emissions uncertainty undermines the very purpose of pricing carbon: to

¹⁵ Though it should be remembered that the cap adopted within the EU ETS is not as stringent as it would need to be to drive emissions reductions on the scale necessary to address climate change.

reduce emissions. Further, in a context where energy prices are rising with little impact on emissions, a tax is anticipated to run into substantial political opposition.

Under a tax, the means for addressing the uncertainty in emissions is to adjust the tax over time, either up or down depending on whether emissions are falling too slowly or the negative effects of reduced consumption are too great (Stiglitz et al. 2017). Notably, however, because regular changes in taxes are unpopular, especially if they involve regular increases in the tax, this approach runs the risk of meeting political opposition such that it stalls the increases necessary to drive an effective transition to a low-carbon economy. One option to address this problem is to tie tax adjustments to emissions goals, such that the tax is adjusted without adjudication by legislators, ideally freeing it from political pushback (Stiglitz et al. 2017). This self-adjusting tax effectively turns the tax into a hybrid tax cap, as emissions benchmarks come to effectively reflect the emissions cap. While this option addresses some of the uncertainty in emissions associated with a tax, it does so by introducing uncertainty in terms of prices (Stavins 2020).

Regarding an emissions cap, the focus is on addressing price uncertainty. In addition to banking (discussed above), the most prominent means to stabilize prices is through the use of price collars. Price collars set limits on the price for permits, creating a price floor if prices get too low (as a result of lower-than-expected abatement costs and/or demand) or a price ceiling, if prices get too high (for the same reason but in the opposite direction) (Cramton and Kerr 2002). A price floor is created legislatively, with permits having a minimum price, or if the system allows for permit banking, by permits being pulled out of circulation for subsequent periods. Price ceilings are created by releasing more permits. As with hybrid taxes, a hybrid emissions trading scheme essentially turns the mechanism into a tax, with a fixed cost for emissions above or below the ceiling or floor (Aldy 2017). This option has the advantage of predictable prices, and in the case of a price floor, a minimum level of ambition on emissions. That said, price ceilings come at the cost of certainty around emissions reduction, by allowing emissions to exceed the cap (Stavins 2020). A price floor can, of course, be applied without a price ceiling and vice versa.

Due to the desire to have some measure of control over both emissions and price stability, it is anticipated that some form of hybrid mechanism is likely in any effort to price emissions. In this respect, the major difference between the two approaches to pricing emissions is anticipated to be limited. As such, some authors suggest that the apparently large difference between emissions trading and taxation are in reality fairly minor, with the bigger differences deriving from the specifics of a pricing mechanism's design (Stavins 2020); for example, where the price will be implemented (upstream or downstream), what will be done with the revenues, whether grandfathering will take place, how and to what extent will exemptions be included, etc.

Having provided an overview of the attraction of a carbon price, as well as the similarities and differences between different pricing mechanisms—motivating for the idea that any such differences are likely overwhelmed by questions of design—the paper now moves on to discuss some salient design questions. These include how to set the emissions price and how to use the revenues.

CENTRAL DESIGN ISSUES FOR CARBON PRICING

KEY MESSAGES

- How to set the price/cap and what to do with the revenues are two central design questions for any emissions pricing initiative.
- The emissions price should be guided by: emissions targets (most suitable for a cap); the social cost of carbon (most suitable for a tax); or technology roadmaps.
- Revenues from carbon pricing could be substantial, and a plan for their effective use is likely essential to maintaining the political palatability of an emissions price.
- The main suggestions for revenue use include: revenue-neutral tax shifting; the creation of a carbon dividend; investment in complimentary policies; sovereign debt repayment; and international transfers to developing countries. Notably these need not be exclusive.
- Any plan for revenue use should account for the fact that revenues will decline over time as emissions fall.

In addition to the design elements introduced under the description of the similarities and differences across pricing mechanisms, two central design questions for any emissions pricing system are 1) how the price/cap should be set and 2) what should be done with the revenues. Due to the centrality of these design questions, the report turns to a detailed discussion of both issues.

HOW TO SET THE EMISSIONS PRICE

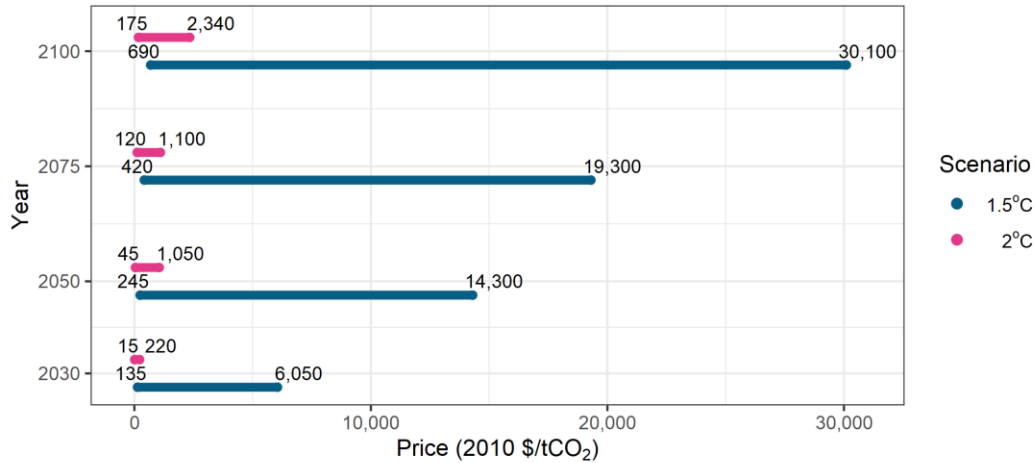
While putting a price on CO₂ produces the least-cost pathway for reducing emissions, the process of inducing that price relies on knowing the appropriate level of climate ambition—essentially how fast society must transition to net zero emissions. Determining the appropriate level of ambition involves questions beyond the scope of a paper on carbon pricing, including: observations from the natural sciences (e.g., determining the sensitivity of the climate to GHG emissions); observations from the social sciences (e.g., regarding the vulnerability of social systems to climate change); and insights from philosophy (e.g., concerning issues of distributional justice). That said, the question of how to determine the relevant cap/price necessary to induce a transition that matches

society's ambition is clearly germane to this paper. The paper now moves to discuss the three major approaches detailed in the literature included in this review. These are: i) emission targets; ii) social cost of carbon; and iii) technological roadmaps.

Emissions targets

Emissions targets describe emissions reduction targets over time and are the simplest approach to determining the carbon price/cap. The target itself is set based on a variety of considerations derived from the disciplines described in the above paragraph and most clearly outlined in the Paris Agreement. Under a cap, intermediary targets can simply be determined and the emissions cap set to reflect those targets. The purchase and trade of permits will then set the energy prices necessary to achieve the required emissions reductions (Boyce 2018). Given the pushback on grandfathering, which does nothing to limit cost passthrough and instead results in a windfall to permit recipients, emissions trading requires a process for discovering prices. This discovery is believed to happen most effectively via an auction. There are a number of ways auctions can be organized, but the general consensus is that uniform price auctions are best, with a weak inclination to follow a single round approach and account for bid shading (Lopomo et al. 2011; Cramton and Kerr 2002). See Annex A for a detailed account.

Emissions targets can also be used to derive carbon taxes. In that case, however, one must estimate the tax level that will be required to induce the necessary reductions in demand (and thereby reduction in emissions). Determining the prices to achieve these declines requires modelling the economy based on inputs that are hard to discern, such as the abatement costs across all sectors of the economy, including how those costs will change over time. The challenges involved in this sort of modelling and the lack of information on abatement costs leads to a wide range of price estimates necessary to meet the goals of the Paris Agreement. For example, the IPCC (2018) estimates that undiscounted values for a 2°C pathway (all in 2010 \$/tCO₂) range from \$15–220 to \$175–2,340 in 2100. For 1.5°C the prices are substantially higher, ranging from \$135–6,050 in 2030 and \$690–30,100 in 2100 (see Figure 2) (IPCC 2018). Due to these high levels of uncertainty, it is thought to be important that any tax be periodically assessed to determine whether the prices are sufficient and should be adjusted as needed (Stiglitz et al. 2017).



Source: IPCC 2018

Figure 2. The range of estimates for CO₂ prices. Source: Author.

Social cost of carbon

An alternative approach to emissions targets is to use the notion of the social cost of carbon. The social cost of carbon is an effort to estimate the costs associated with the emissions of CO₂ based on the damages those emissions will generate. The idea behind the social cost of carbon is that once you know the cost of emissions, you can set the tax equal to that price, which should result in an accurate allocation of costs and benefits for all consumption decisions (Boyce 2018). While theoretically straightforward, the process of determining the social cost of carbon is extremely difficult. It requires the use of integrated assessment models that seek to link climate science’s understanding of climate impacts with economics to determine the value of those things that will be lost or damaged by climate change. Challenges in this process derive from (Boyce 2018):

1. Our limited ability to price things that are not regularly traded on the market, or for which their value is inalienable and for which money is a poor estimate of value (Morrissey and Oliver-Smith 2013);
2. our lack of knowledge about the damages associated with large temperature increases—more than 3°C—as models tend to simply extrapolate the damages from low temperature-increase models, despite there being substantial concern that damage functions are not linear;
3. the challenge of dealing with catastrophic risks. These tend to be dealt with by multiplying an event’s probability by its impact. However, if climate change is altering the probabilities in ways that are not clear, then the damage estimates are vulnerable to substantial error. This problem is compounded under high temperature-increase scenarios, where changes to the impacts and probabilities are not linear;

4. debate over discount rates. Discount rates refer to the degree to which someone values consumption now compared to consumption at some point in the future, with the general theory suggesting that people value consumption in the future less than they do consumption now. Notably, the size of the discount rate can greatly change the social cost of carbon because future damages (and foregone future consumption) can be made less valuable. There is significant debate about what the discount rate should be, as well as how applicable it is to climate change in general, where the well-being of future generations is at stake and those individuals have no option to consume now;
5. the models determining the social cost of carbon tend to ignore the co-benefits that can result from reducing CO₂ via their impact on other harmful pollutants.

Given all these challenges, results of efforts to determine the social cost of carbon are also subject to large variances. These variances make setting a carbon tax based on these values extremely difficult. Nonetheless, the social cost of carbon can be a useful concept for informing investment decisions. For example, the Obama Administration's use of a median estimate of the social cost of carbon as part of cost-benefit analysis regarding future investments has driven an investment portfolio that reflects greater ambition on climate change. Displaying the limitations of the tool, however, the Trump Administration effectively undermined the value of using the social cost of carbon in cost-benefit analysis by simply applying a much higher discount rate (Plummer 2018).

Technological roadmaps

A final mechanism for determining prices/emissions caps is the use of technological roadmaps; for example, clean energy standards mandating that 50 percent of electricity come from renewable sources by a certain date or reach some efficiency standard for vehicles by a specific date. These sorts of goals are not meant to set the legislative agenda for decarbonization (as doing so would undermine the advantages of a least-cost approach), but rather to provide points of focus for understanding the prices at which technology switches take place; for example, between internal combustion engines and electric vehicles, which can be used to aid in price setting (Stiglitz et al. 2017). Despite this effort to focus on switching prices, it is noted that these can still be difficult to determine, as they rely on hard-to-predict variables such as the cost of fossil fuels. Further, in contexts where technologies are rapidly changing, switching prices change rapidly (Stiglitz et al. 2017). Again, however, because the transition to a low-carbon economy will require nonmarginal and unprecedented changes in energy systems and other emitting activities, efforts to assess the price necessary to induce the required technological shifts produce highly variable prices. For example, Stiglitz et al. (2017) point out that scenarios for limiting warming to 2°C

(> 66 percent probability) imply CO₂ prices with a range of between \$15–\$360/ton in 2030 and \$45–\$1,000¹⁶ in 2050 (Stiglitz et al. 2017). Such large ranges show the problems with trying to use prices to drive down emissions and have led some authors to argue that these large ranges are the fundamental reason for privileging a cap over a price when it comes to addressing the climate emergency (Boyce 2018).

HOW TO USE THE REVENUES

The revenues that could be potentially generated by a carbon price are substantial. Taking US CO₂ emissions in 2019 (5.2 billion tons) (Friedlingstein et al. 2020) as an example and using a price of \$230/t raises revenues on the order of a trillion dollars (though this amount could be less in reality, as a carbon price would serve to reduce emissions) (Boyce 2018). Further, and as was mentioned above, because low-income households tend to spend a larger portion of their income on energy than do wealthier households, the use-side effects of a carbon price are likely to have highly regressive impacts. The scale of such potential regressivity is substantial to the point that one study found that the pursuit of ambitious emissions targets might do more harm to food security (through increased energy prices) than would have occurred under higher temperatures that would have resulted from less-stringent emissions reductions (Hasegawa et al. 2018). Since revenues have been identified as an important means for addressing such negative outcomes, a discussion of their potential uses is considered essential.

A notable feature of the literature on carbon pricing is the focus on revenue-neutral, tax-shift approaches as the preference for many economists. Under such an approach, the revenues raised through a carbon price are used to offset reductions in other taxes such as income, payroll, or corporate taxes (Stavins 2020; Stiglitz et al. 2017; Aldy 2017). The preference for this approach lies in the distinction between what economists call “distortionary taxes” and “Pigouvian taxes.” The former refers to taxes that, according to neoclassical economic theory, move the market away from its most efficient equilibrium by diminishing the incentive for economic productivity, e.g., the reduction in incentives to increase profits that are created by corporate taxes. Pigouvian taxes on the other hand serve to correct for some undesirable market distortion or externality, such as the undervaluing of the carbon budget. Thus, the theory goes, by switching a distortionary tax for a Pigouvian one, you receive a “double dividend” that results from i) correcting the market distortion as a result of the new tax and ii) addressing an existing distortion created by existing taxes. Additionally, in the case of an upstream price, which is relatively easy to administer in comparison to

¹⁶ All in 2005 prices.

an income tax, it is also possible to increase collection efficiency, thereby further improving the revenue base (CPLC 2016). Effectively, a revenue-neutral, tax-shifting approach serves to increase economic growth by reducing distortionary taxes, maintaining fiscal space for public investments, and addressing the challenge of climate change in the cheapest way possible (Stavins 2020). Under this approach, it is generally felt that the allocation of tax revenues should be determined by the multiple priorities of the state, with the push being for rational policy making. Thus, revenues should be available for flexible expenditure, rather than ring-fenced for specific expenditure types (Carattini, Carvalho, and Fankhauser 2017).

While the appeal of maximizing overall economic efficiency is attractive to many economists, it has been criticized on several grounds. First, it does nothing to address the regressive use-side impacts¹⁷ of a carbon price (Stiglitz et al. 2017; Stavins 2020; Boyce 2018; Goulder et al. 2019). Second, it likewise does nothing to address existing systemic inequalities in society. Finally, a tax-shifting, revenue-neutral approach fails to account for the realities of a political economy that might undermine support for a carbon price (see below for a more thorough discussion of the political palatability of carbon pricing). For example, there might be mistrust of the government's capacity to judiciously use tax revenues and a lack of public understanding of, or faith in, the neoliberal theory of first-best economic choices, i.e., those that drive the overall market as close to equilibrium as possible by removing economic distortions (Stavins 2020; Klenert and Hepburn 2018).

A few alternative approaches exist that address the criticisms of the revenue-neutral, tax-shifting approach. The first is to target the tax shifting towards low-income households; for example, by removing payroll or income taxes for households at the bottom of the income distribution (Goulder et al. 2019). Such an approach shifts the overall tax system to a more progressive state, thereby alleviating the potential for the overall impact of the carbon price (resulting from the sum of use-side and source-side impacts; see above) to be regressive, while also potentially improving overall economic efficiency through the removal of certain distortionary taxes.

A second approach is to simply return the revenues from the carbon price to all citizens through the use of a lump-sum rebate or carbon dividend (hereafter "dividend"), paid out on a per capita basis (Aldy 2017; CPLC 2016). Such an approach ends up being substantially progressive because wealthy households tend to spend more on energy than low-income households (even if the proportion of their total income spent is smaller), meaning wealthy households

¹⁷ Recall that use-side impacts refer to the increased cost of using carbon-intensive goods that results from the implementation of a carbon price. Source-side impacts refer to the changes to policy determined by government transfers and to returns from different factors of production that result from the carbon price.

pay more in carbon taxes. Since the revenues are recycled on a per capita basis, low-income households receive more than they pay, while wealthy households experience the opposite, making the dividend approach highly progressive (Fremstad and Paul 2019; Stavins 2020; Boyce 2018). A further potential advantage is that putting money directly back in people's pockets stands to render the approach more politically palatable than efforts to recycle revenues into the budget.

The downside of a dividend payment is that it forgoes the opportunity to address distortions in the economy as articulated in neo-classical accounts, such as the existence of distortionary taxes or other market failures. In this respect, the dividend approach is considered the most expensive approach to revenue use in that it completely foregoes potential increased economic activity (Stavins 2020; Stiglitz et al. 2017). Further, while a "carbon dividend" would address regressive use-side impacts, it likely requires people to be formally registered to receive the dividend. If poorly designed, this approach could ignore marginal and impoverished populations, such as unbanked individuals, people without a permanent address, or those lacking a social security number. Such populations would be paying higher prices for goods, via cost passthrough, but have no way of receiving the dividend. Finally, it should be noted that while a carbon dividend should help address vertical inequalities (i.e., inequalities in income or wealth across households/individuals), its impacts on structurally determined historic horizontal inequalities (i.e., inequalities across social groups based on race, gender, and age) could be zero or even negative (especially in the case of local pollution-induced inequalities) (Boyce 2018).

It should be noted that returning revenues to citizens does not undermine the effectiveness of a carbon price as a means for reducing emissions. Even when returning revenues, the incentive remains for people to purchase the cheapest goods and services they can, and the price retains the impact of raising the cost of carbon-intensive goods compared to alternatives (Boyce 2018). Essentially, even with the money back in people's pockets, they will be incentivized to make fewer carbon-intensive purchases, so that they can spend that money on other things. One potential exception is evidence that electricity consumption does not trend linearly with income, with low-income households potentially making more energy-intensive energy choices at the margin (most notably in the case of increased incomes driving increased expenditures on energy-intensive air conditioning) than do wealthy households (Davis and Gertler 2015).¹⁸ Should this specific finding hold more generally and there be difficulty in decarbonizing the

¹⁸ The specifics of this study are worth elaborating on. The authors looked at how electricity consumption responds to increases in income, as well as increases in temperature, in Mexico. They found that energy consumption had the most elastic response to increased income among low-income households for whom large increases in energy consumption were a result of purchasing energy-intensive air conditioning. These impacts were compounded by increasing temperatures (Davis and Gertler 2015).

electricity grid, the initial redistribution of wealth via a dividend could lead to an initial increase in emissions compared to a less-progressive approach. Notably, however, none of the literature consulted in this review explored this question directly, so it should therefore be considered a speculative concern.

The third major potential use of revenues is to specifically make them available for complementary climate investments (i.e., investments suffering from other market failures) (Aldy 2017). This use could include, for example: investments in public transport; investments in R&D; the rollout of electric vehicle-charging infrastructure, etc. This approach has the advantage of addressing other market distortions and catalyzing the emissions reductions achieved by a carbon price. A further option is to use the revenues to address site-specific environmental injustices, such as particulate concentrations in neighborhoods proximate to heavy industry. While efforts of this sort could serve to address issues of horizontal inequality overlooked by a dividend-only approach, their lack of flexibility can limit policy effectiveness. Without a clear mandate for prioritizing investments, such an approach could be criticized for lacking oversight and accountability.

A final potential use of revenues that is mentioned in the literature is to pay down sovereign debt (CPLC 2016; Aldy 2017). This approach has the advantage of lowering interest rates, which can serve to decrease the overall cost of new investments (most notably for capital-intensive renewable energy) and thereby catalyze further investment in such goods. It should be noted, however, that debt repayment is thought to garner little political support, as debt is an abstract concept with unclear impacts on the economy. Increased energy prices on the other hand are felt in everyday expenditures. This reality could create challenges in terms of political acceptability (CPLC 2016).

Beyond these uses, a novel idea recently promulgated by actors at Open Oil, The Heinrich Böll Foundation, The Center for Sustainable Finance (SOAS, University of London), and The Global Development Policy Center (Boston University) is to use the revenues to compensate developing countries for the revenues they would forego by leaving fossil fuels in the ground. In their report, the authors use oil industry techniques of asset valuation (which are the basis for contracts that countries sign with oil companies to determine payments for rights to oil exploitation). Based on an assessment of a subset of countries (Lebanon, Uganda, and Mozambique), the report suggests that the value of these assets to developing countries, considering the size of their reserves, produces an abatement of cost for CO₂ of between \$2–\$10/ton, with scope to abate 400 Gigatons of CO₂, in “new producer” countries¹⁹ alone (West 2020). Given that

¹⁹ These include Namibia, São Tomé and Príncipe, Angola, Democratic Republic of the Congo (DRC), Mozambique, Malawi, Tanzania, Kenya, Uganda, Somalia, South Sudan, Sudan, Nigeria, Ghana, Côte d'Ivoire, Liberia, Sierra Leone, Senegal, Mauritania, Iraq, Afghanistan, and Pakistan.

carbon will need to be priced significantly higher than this to avoid dangerous climate change, there is scope to use some portion of the revenues to abate emissions abroad, thereby creating the possibility of advancing both domestic and international equity. Revenues could likewise be used to fund adaptation and/or loss and damage in developing countries in pursuit of international equity, as has been advocated in previous Oxfam report on carbon pricing (Gore and Lutes 2011; Coleman 2008).

As is hinted at above, it should be obvious that revenues need not be used for only one of these ends. They could, all at one time, be used to reduce distortionary taxes, invest in green infrastructure and R&D, pay out dividends, pay down sovereign debt, and support equity-focused investment in developing countries. Doing so could manage concerns about efficiency with progressivity and equity. Regardless of the approach adopted, two overall messages remain salient when making decisions about how to use revenues. First, as mentioned above, assuming (in the case of a cap) permits are not given away, revenues from carbon pricing are liable to be large, and there is believed to be value in having a plan to manage them to ensure they are not used poorly or in ways that undermine public support for ongoing emissions pricing.

Second, as emissions pricing works to reduce emissions, the size of the revenues generated by the scheme will shrink.²⁰ Over the medium term, this shrinkage could create budgetary pressure. The budgetary pressure can be especially challenging to manage if revenues were used to increase public expenditure, which incurs its own long-run operations and maintenance costs (CPLC 2016). As a result, it may be wise to focus the revenues on investments that alleviate the burden of increased costs created by an emissions price. Otherwise, forethought should go into how any additional budget expenditures might be maintained as revenues from carbon pricing eventually fall. The challenge may be substantial given the mismatch in timelines between declining revenues (long term) and political gains to be had from expanded public expenditure (short term).

²⁰ This can, and should, be addressed by increasing the tax/decreasing the cap, as the emissions requirements of the carbon budget tighten over time. Despite doing so, however, at some point the revenues will dwindle as emissions fall.

THE STATUS OF CARBON PRICING

KEY MESSAGES

- The current state of carbon pricing is inadequate. In the vast majority of cases, prices are too low and/or coverage is too limited to galvanize the sort of action that would be necessary to address dangerous climate change.
- Nonetheless, carbon pricing is showing a steady expansion in terms of both total economic sectors covered and revenues raised (this expansion, however, remains too slow to ameliorate the concerns of the above bullet).
- The empirics on the impacts of carbon pricing suggest that the theory is largely accurate. However, the robustness of this evidence is limited by the lack of ex-post empirical works and the reliance on a single pricing system (the EU ETS).
- Some important debate still exists in the literature as to whether carbon pricing will drive the realization of new technologies that will be needed to transform the global energy system and whether it is carbon pricing or other policy initiatives that have done most of the work in driving emissions reductions to date.

Given the degree to which carbon pricing is thought by many to be both central to efforts at addressing climate change and the cheapest way to go about the task, a salient question is: what is the current status of carbon pricing? Further, does the empirical evidence on carbon pricing confirm or undermine the theoretical arguments provided above? The next section turns to an investigation of both these questions. In short, it will argue that while carbon pricing is seeing increased global uptake, prices and/or coverage are almost uniformly too low to create the imperative necessary to tackle climate change. Regarding the empirics, the evidence suggests that the theory on carbon pricing largely appears to hold. However, due to low prices and weak coverage, impacts on emissions reduction are relatively small (and variable across sectors). It is also the case that robust empirical evidence is lacking. This lack of evidence is a notable oversight given the prominence of carbon pricing in climate policy. Nonetheless, impacts on competitiveness of carbon pricing appear limited (though noting the low prices and limited coverage), and impacts on innovation are unclear. It is also unclear whether carbon pricing is a more effective means for combatting climate change than other regulatory initiatives.

THE CURRENT STATE OF CARBON PRICING

The current state of carbon pricing in the world is a matter of serious concern. While carbon pricing has continued to grow over time in terms of the number of jurisdictions covered, the share of the global emissions, and the revenues generated, current coverage and price is still far too low to galvanize the scale of emissions reduction necessary to meet the goals of the Paris Agreement and avoid dangerous climate change (World Bank 2020).

These overall trends are shown in Figures 3 and 4 below. Figure 3 shows the steady (and ongoing) expansion of carbon pricing since the early 1990s, both in terms of the number of countries adopting carbon pricing and share of global emissions covered by each country. It further shows the steady growth in revenues that result from these pricing efforts, totaling around \$45 billion at the end of 2019 (World Bank 2020).²¹ Notably, this trend is anticipated to continue into the future, with more countries and jurisdictions announcing plans to implement emissions pricing instruments (World Bank 2020). At the same time, however, it shows that carbon pricing only covered a little over 15 percent of global emissions in 2020 (World Bank 2020).

²¹ Notably, the 2018–2019 increase was only around \$1 billion. This is a relatively small increase compared to the \$11 billion increase between 2017–2018, which occurred as a result of the stabilization of the EU ETS price (see Figure 3).

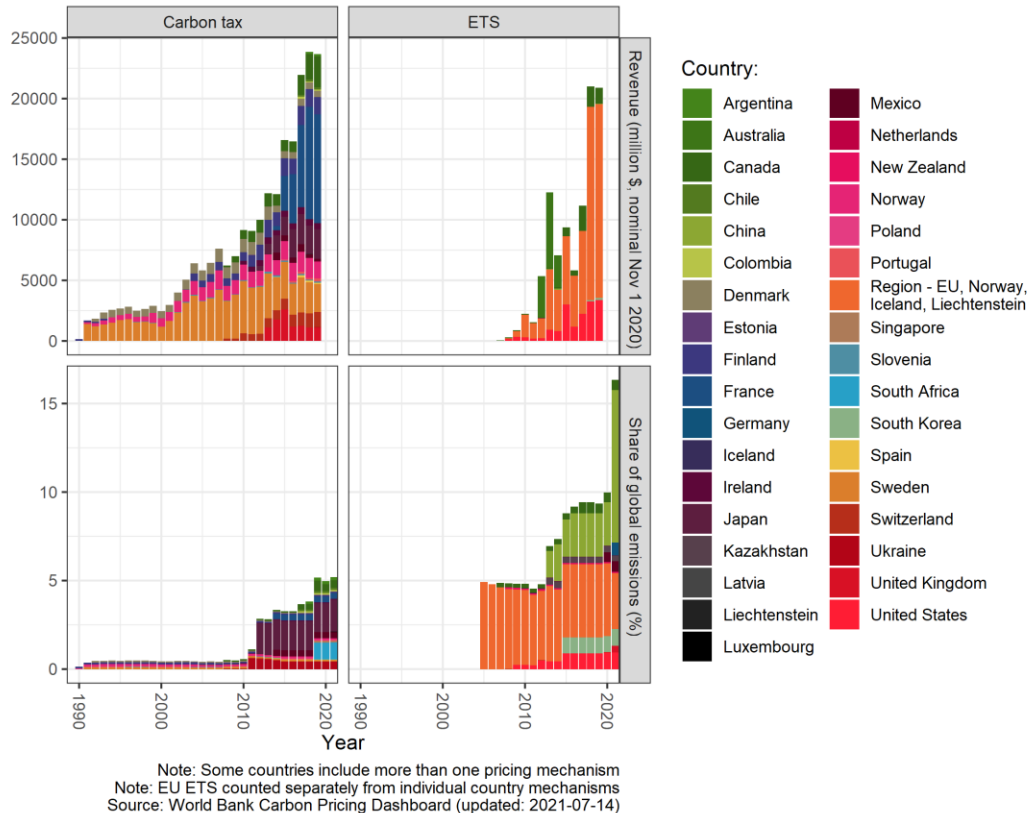
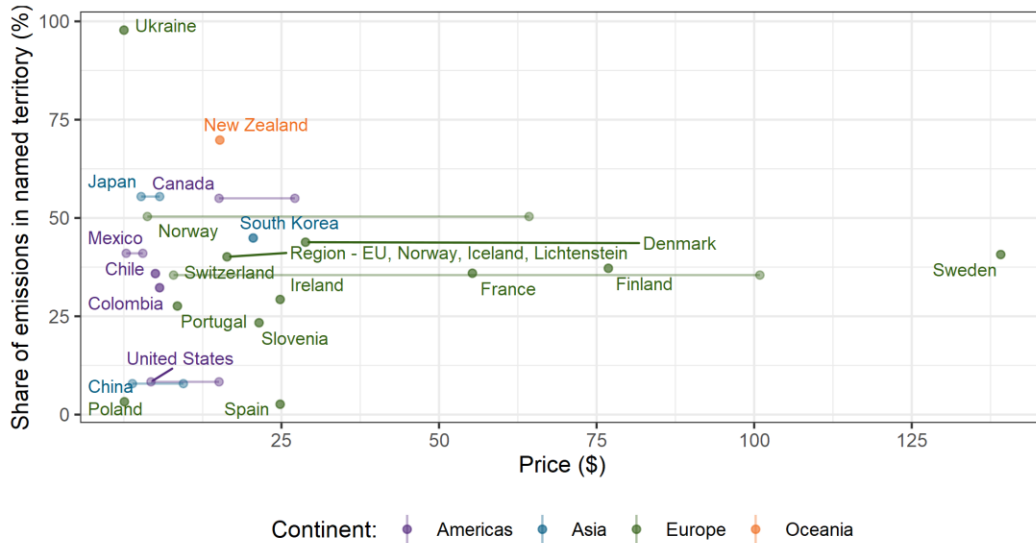


Figure 3. Comparing emissions coverage and revenues across carbon taxes and emissions trading schemes. Showing the increasing scope of carbon pricing. Note that some countries include more than one pricing mechanism (i.e. a tax and a price). Also, EU ETS counted separately from individual country mechanisms. Source: Author.

Figure 4 highlights further problems: carbon prices and coverage are highly variable, with about half of the countries invoking a price of less than \$10/ton, well below what is believed to be necessary to meet the goals of the Paris Agreement (believed to be closer to \$75–100/ton) (Boyce 2018; World Bank 2020; Stiglitz et al. 2017; Dolphin, Pollitt, and Newbery 2020). For reference, a \$100/ton CO₂ price would increase the cost of gasoline by \$0.89/gallon or \$0.23/liter.²² Sweden is the only country applying a suitably high price (World Bank 2020). Of further note is the extent to which emissions pricing is heavily concentrated in Europe, where the EU ETS is in effect and where it is complemented by a number of national carbon pricing efforts.²³

²² Based on the US Energy Information Administration (EIA) estimate that 1 gallon of gasoline contains 19.6 lbs of CO₂. See https://www.eia.gov/environment/emissions/CO2_vol_mass.php.

²³ Note that for many European countries in Figure 4, the coverage is higher than appears because coverage in the EU ETS adds to coverage achieved by national pricing schemes. These numbers cannot simply be added together because the emissions sources covered are specific, while the specific structure of the economies involved is distinct.



Note: European countries in regional and national schemes therefore country coverage higher than immediately appears.
 Note: Ranges reflect different prices for different mechanisms in a region, or price collars.
 Note: Due to data limitations data should be seen as indicative only.
 Source: World Bank Carbon Price Dashboard and European Database for Atmospheric Research (updated 2021-07-15).

Figure 4. Share of emissions vs. carbon price by territory. Showing that carbon pricing mechanisms are currently insufficient. As noted, some countries have individual schemes as well as being in regional schemes (notably EU countries), thus actual country shares of under a pricing scheme may be higher than they appear – though prices would also differ to what appears here. Source: Author

Compounding the issue of low prices is the fact that, other than a few exceptions where commitment to pricing has been high and price increases have been steady over time, prices have tended to rise extremely slowly or flatten out. Figure 5 shows this finding to be the case. Notably, these prices are in nominal terms, and trends would look even worse if represented in real prices. Again, the image shows the extent to which commitment to emissions pricing is heavily concentrated in Europe. Overall, this picture suggests a world in which carbon pricing is growing in scope but at a rate nowhere near sufficient to serve as a credible instrument for addressing climate change. Further, the state and history of prices, as well as the geographic concentration of pricing efforts, suggest political will on the policy is extremely difficult to manifest. See section on arguments against carbon pricing and addressing the unacceptability of carbon pricing below for a longer discussion.

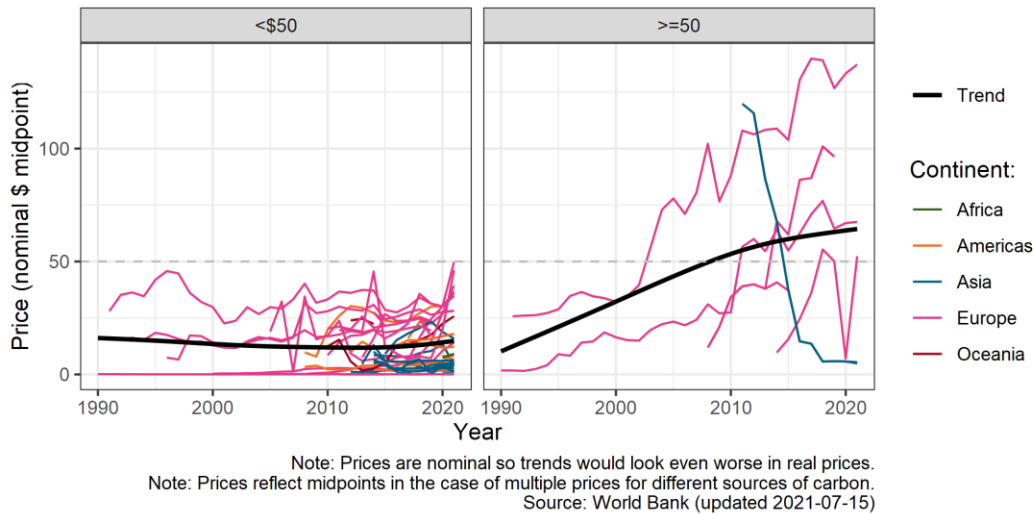


Figure 5. Trends in emissions prices distinguished by initiatives that have ever seen prices above \$50. Showing that for most initiatives prices are rising too slowly. The lack of price increases is more alarming when one notes that prices above are nominal (i.e. not accounting for inflation). Flat nominal prices possibly reflect declining real (i.e. inflation-adjusted) prices. Source: Author.

In terms of revenue use across initiatives, around half was dedicated to environmental or development projects, with 40 percent going to the public budget, and the rest to tax cuts and direct transfers. The impacts of COVID-19 on revenues is currently unclear, but a number of countries have decided to hold off on price increases as a result of the pandemic, with decreased demand anticipated to compound reduced revenues (World Bank 2020).

A final point worth noting on the state of carbon pricing pertains to the use of internal carbon prices. Internal carbon prices are voluntarily implemented by companies to understand the impact legislated carbon pricing might have on their operations. The exact way in which internal carbon pricing is implemented varies by case, with some companies simply applying a carbon price to understand the impact it would have on operations (generally known as a shadow price) and others actually paying revenues that are then dedicated to investments that reduce the company’s carbon footprint or buy offsets (see below for details) (Ahluwalia 2017). Regardless, the World Bank (2020) identifies significant growth in the use of internal carbon pricing, with the practice now known to be in existence in more than 1,600 companies. This growth is thought to be important, as the application of internal carbon pricing is likely indicative of diminished political opposition to future efforts to price emissions. Notably, however, those prices are, in general, thought, to be fairly low—between \$5–\$20/ton—so as to not overburden business units and ensure internal buy-in (Ahluwalia 2017). Further, they tend to be limited to scope 1 and 2 emissions²⁴, with scope 3

²⁴ Scope 1, 2, and 3, refer to different sources of emissions associated with economic activity. Scope 1 emissions are those controlled by the organization producing the

emissions being ignored as they can be difficult to track (Ahluwalia 2017). Note this limiting prices to scope 1 and 2 emissions applies to all (compliance) carbon pricing systems.

EMPIRICS ON CARBON PRICING

Having both detailed the theory behind emissions pricing and articulated the status of efforts to price CO₂, a looming question pertains to whether empirical assessments of emissions pricing support the theoretical claims described above. While a systematic review of the empirical literature on carbon pricing is beyond the scope of this work, it is thought necessary to try to provide an informed account of the empirical work. To this end, this report has sought out (using Google Scholar) systematic reviews of ex-post empirical studies.²⁵ As these were found to be remarkably sparse, the report then undertook a further Google Scholar search for individual ex-post empirical studies on carbon pricing, using snowballing to identify notable studies (17 in total). Within these individual studies, author conclusions on the state of the literature are treated as comparable to more systematic reviews. Below I discuss the findings of the studies, as well as reflect on author accounts of the state of the empirical literature. While this approach is an imperfect one, it is thought to capture the empirical consensus in broad-brush terms. The overall findings of the systematic reviews are discussed below, while the review of the 17 empirical accounts appears in Annex B.

A first notable finding from the literature on carbon pricing is the degree of agreement on the lack of empirical evidence on the impacts of carbon pricing (Bayer and Aklın 2020; Teixidó, Verde, and Nicolli 2019; Green 2021; Narassimhan et al. 2018). Explanations for this focus on the challenge of untangling confounding and endogenous factors (Green 2021; Narassimhan et al. 2018), and the lack of available firm-level data, which would be necessary to address endogeneity problems by allowing for econometric analysis (Teixidó, Verde, and Nicolli 2019; Shen, Tang, and Zeng 2020). A further problem pertains to the dominance of studies focused on countries implementing prices under the EU ETS, mainly due to the size and age of the initiative, and the availability of detailed data in some EU countries (Green 2021; Wang, Gao, and Dai 2019). Overall, this lack of empirical evidence is concerning, with the empirical literature

good or service. Scope 2 emissions are indirect, in that they derive from goods and services purchased from another organization (e.g. electricity, steam or heat), but which are consumed by within the organization producing the good or service. Scope 3 emissions refer to those emissions that derive from the consumption of goods/services by purchasers of those goods/services. In this way, the scope 1 and 2 emissions of one organization are the scope 3 emissions of another organization.

²⁵ i.e., studies conducted on the observed impacts of pricing using methods aimed at identifying causality.

criticized for being lacking, contradictory (in part because of the use of variable methods (Runst and Thonipara 2020)), overly reliant on a single initiative, and unable to deal with some relevant phenomena, such as the role of leakage and offsets in emissions pricing efforts (Green 2021; Bayer and Aklin 2020). The lack of robust empirics is troubling given the degree to which carbon pricing has dominated policy discussions.

Keeping the above concerns in mind, the overall state of the empirical literature suggests a mixed picture. Arlinghaus (2015), in a review of ex-post empirical works on the EU ETS, concludes that most studies find evidence of substantial abatement. Narassimhan et al. (2018) and Green (2021), on the other hand, conclude the impacts on abatement are small, ranging between 1–4 percent (Narassimhan et al. 2018) and 1–1.5 percent (Green 2021) per annum in the EU ETS. Part of the discrepancy here derives from what one considers “small.” A 12 percent reduction in emissions from regulated sectors between 2008–2015, for example, translates into a 1.7 percent annual reduction in emissions. Green (2021) rightly points out that this reduction is far too little to meet the Paris goals (let alone address dangerous climate change). Arlinghaus (2015), on the other hand, notes that abatement is substantial given the extremely low prices in place. All reviews agree that levels of abatement vary substantially across sectors, tending to be highest where substitutable technologies or fuels are readily available (mainly electricity) and lowest in sectors still requiring technological transformation (e.g., transport fuels). They further note that issues of poor design (over-supply of permits and excessive grandfathering) in the early phases of the EU ETS are thought to have played a role in skewing average assessments of abatement downward (Green 2021; Narassimhan et al. 2018; Arlinghaus 2015). In China, where the emissions trading system (ETS) is still in a pilot phase, Wang et al. (2019) suggest impacts are inconclusive, while Shen et al. (2020) note highly variable findings, with documented reductions ranging between ~0–24 percent.

The individual studies consulted as part of this review support the claims around emissions abatement: numbers are small but substantial given the low prices and limited coverage. Studies also found that carbon pricing has been found to be better at stimulating low-carbon innovations than at driving its adoption, with most emissions reduction being the result of deploying existing technologies (such as fuel switching) rather than due to the development and implementation of innovative technologies (Teixidó, Verde, and Nicolli 2019). The phenomenon of cost passthrough has been observed and is substantial. However, the degree to which costs are passed through fully or not varies by sector (Gugler, Haxhimusa, and Liebensteiner 2020; Arlinghaus 2015; Dechezleprêtre, Nachtigall, and Venmans 2018). Impacts on competitiveness are found to have been minimal. However, this finding may not hold for higher prices (Gugler, Haxhimusa, and Liebensteiner 2020; Arlinghaus 2015; Dechezleprêtre, Nachtigall, and Venmans 2018). There is debate as to whether carbon pricing or other policies have done

more to reduce emissions where emissions reductions have been observed (Green 2021; Bayer and Aklin 2020; Gugler, Haxhimusa, and Liebensteiner 2020).

Notwithstanding concerns about the lack of empirical work on carbon pricing, as well as the over-reliance on assessments of the EU ETS and its supplementary taxes in a limited number of countries, some reasonable conclusions appear to emerge from within the literature:

- First, carbon pricing appears to work to abate emissions. The extent to which this is true, however, varies across sectors and initiatives;
- second, the impact of carbon pricing to date has been too small to meet the goals of the Paris Agreement (not to mention address the threat posed by climate change). This small impact is likely explained by low prices and excessive grandfathering (this point raises the need to increase prices, which, in turn, points to clear political challenges that will be discussed below);
- third, impacts on competitiveness are extremely minor if they exist at all, though this may well change under initiatives exerting higher prices and involving less grandfathering;
- fourth, the degree to which carbon pricing will be able to drive technological investments on the scale necessary to tackle climate change is unclear (in part to due to low prices and excessive grandfathering). Notably, existing initiatives have not manifested the investments necessary, with most emissions reductions taking place in sectors where fuel switching or efficiency gains are possible, with little change in sectors where technological breakthroughs are necessary. It should be noted, however, that economic theory predicts the need for complimentary measures to carbon pricing, such as investment in R&D;
- fifth, firms effectively pass through costs, though they do so to differing degrees. Passing through of costs is true for both auctioned and grandfathered permits, though it is unclear whether the full opportunity cost of grandfathered permits is always realized by firms;
- finally, it is unclear whether carbon pricing is more or less effective than other regulatory measures for addressing carbon emissions.

As a final note, it is worth pointing out that a number of theoretical papers on carbon pricing point to empirical works on pricing Sulphur Dioxide (SO₂) as part of efforts to substantiate the economic theory underpinning carbon pricing²⁶. While there is some debate about how much of a role SO₂ pricing played in the

²⁶ SO₂ was priced as part of US efforts to address the threat of acid rain created by the burning of coal.

phase-out of the gas, empirical work suggests that banking allowed for emission rates to decline faster than might otherwise have happened (Goulder and Schein 2013). Further, banking of SO₂ permits was found to reduce price volatility, even if SO₂ permit prices remained more volatile than average stocks (Goulder and Schein 2013). Finally, SO₂ pricing is credited with effectively driving innovation as, within the first decade of trading, the marginal abatement price of SO₂ fell to less than half of what analysts had predicted (Boyce 2018).

ARGUMENTS AGAINST CARBON PRICING

KEY MESSAGES

- Carbon pricing has faced increasing criticism on the basis that it has not achieved substantial emissions reductions or the prices/coverage that would be required to drive such reductions.
- A number of these criticisms deserve serious consideration, in particular the lack of political palatability of carbon pricing and its potential inadequacy compared other policies.
- Exact resolution of these criticisms is not possible, and ideological commitment to certain policies is likely unhelpful: the policy effort should go where the political momentum is.

Compelling theory, weak application of the policy (in terms of price and coverage), and mixed empirical results—the interpretation of which is muddled by a range of methods-weak data and the weak application of the policy—have resulted in an emergent debate about the value of carbon pricing. The forcefulness of these debates varies, from some authors who argue that carbon pricing is attractive but insufficient to address climate change to others who argue that carbon pricing is wholly undesirable as a policy. This next section of the report seeks to engage with these debates. While the below is not a comprehensive evaluation of formal arguments against carbon pricing, as arguments are scattered across grey literature, blogs, and other policy forums, it is an effort at a good-faith articulation of the different arguments that are made against carbon pricing, along with a reflection on their merits and limitations. Some of the arguments are not easily resolved. The aim of this section is not to come down on a position for or against carbon pricing, but rather to facilitate Oxfam staff reflection on these different positions. The array of arguments to be discussed below can be summarized as carbon pricing being an unfavorable policy because it is: a) regressive; b) an incremental approach (and there is no time for incrementalism in the face of the climate emergency); c) incapable of addressing climate change because it does not tackle the root of the problem (which is the extraction of fossil fuels) or because demand for fossil fuels does not respond to prices; d) uniquely politically inadequate to the extent that prices and coverage will never get high enough to address climate change; and e) a problematic response to a larger crisis of capitalism, rather than a meaningful solution.

REGRESSIVITY: INCOME

First, concerning the argument that carbon pricing should be opposed because it is regressive and its impacts will be felt disproportionately by low-income households for whom the impacts will be intolerable (Carattini, Carvalho, and Fankhauser 2017; Mildenerger and Stokes 2020). As pointed out above, while this is true on the use-side (see above section on similarities between carbon taxes and carbon caps), there is some debate as to whether the overall impact of use- and source-side effects will be regressive or progressive. For example, Fremstad and Paul (2019) find that the “double dividend” of a tax-shifting approach to revenues is, alone, insufficient to address the regressive use-side effects, as the benefits of economic growth fail to trickle down. Goulder et al. (2019), on the other hand, find that the positive impact on other government transfers (assuming these remain pegged against the consumer price index) tend to make the overall effect of the carbon price progressive among the lowest-income quintile in the US. Regardless of this debate, it is widely accepted that the effective use of the revenues generated by carbon pricing can make the source-side effects substantially progressive to the point that they overwhelm the regressive use-side impacts (Fremstad and Paul 2019; Goulder et al. 2019; Stavins 2020). Potential reliance on the effective use of revenues to ensure progressivity creates the risk that revenues will not be used to this end, and thus carbon pricing could be regressive. This risk exists for most other policies (e.g., subsidies, regulations etc.), which, if poorly designed, could result in regressive outcomes.

REGRESSIVITY: ENVIRONMENT

In addition to concerns around fiscal regressivity, carbon pricing is also criticized for potentially driving environmental inequalities that result from the emission of pollutants associated with CO₂ (e.g., VOC, NO₂, PM2.5, etc.) and create very real concerns for environmental justice. The hypothesis here is that sites of CO₂ emissions with high abatement costs are disproportionately located in historically marginalized areas. Since a carbon price will result in technology switching and emissions reductions in facilities with low abatement costs first, a price-based approach will result in reduced CO₂ emissions (and thereby reduced emissions of associated pollutants) in economically well-off areas, while emissions remain high in marginalized areas (which have been sites of historic exposure to pollutants). As per the logic of carbon pricing, the reduced CO₂ emissions will benefit everyone equally by reducing rates of global warming. However, only those well-off areas will see improved local air quality. As a result, environmental inequalities (and their often racial basis) stand to be exacerbated (Cushing et al. 2018).

As a result, there has been some push-back on price-based approaches in favor of regulatory approaches that explicitly target facilities that produce large amounts of local air pollution (Fowlie, Walker, and Wooley 2020). This position has been particularly popular with environmental justice groups in industrialized nations that have long been focused on air quality issues and their intersection with race. These groups see the current focus on climate change as a lever to address both global warming and local pollution issues, and argue that the approach should therefore be on regulating polluting industries that operate in low-income areas so as to ensure that emissions in these areas are addressed, rather than seeking a least-cost approach that might allow such differentiated pollution to persist (Fowlie, Walker, and Wooley 2020).

The above thesis appears to be supported by mixed evidence, at least in California where most work on this topic has been done. Cushing et al. (2018), for example, looked at the first three years of California's ETS and found that facilities that saw an increase in GHG emissions were located in neighborhoods with greater proportions of people that are of color, are living in poverty, have less education, and have greater levels of linguistic isolation (Cushing et al. 2018). Fowlie, Walker, and Wooley (2020), on the other hand, note that the weight of evidence from evaluations of California's ETS suggests that it has delivered equal or greater air quality improvements among disadvantaged communities (though they note untangling the impact of different policies has been made challenging by the implementation of multiple policies at once). It has been pointed out that regulation for addressing global climate change might not be well suited to addressing local pollutants and that perhaps alternative approaches should be adopted; either a complimentary regulatory approach (such as requiring emissions reductions from facilities located in low-income areas) or an emissions pricing mechanism focused on those pollutants (Fowlie, Walker, and Wooley 2020). At the same time, it is entirely understandable that groups that have faced years of environmental inequality would not accept an approach that promises to address local air quality issues through additional policy, after climate change policy gets implemented. Such a position is especially understandable given the extent to which issues of environmental racism have been neglected for so long.

Regardless of the exact state of the evidence, the above argument presents a challenge for Oxfam. On the one hand, issues of environmental justice (including their generally racist underpinnings) are real and should be priorities for actors concerned with climate change, especially actors such as Oxfam for whom climate change is primarily an issue of environmental justice. Further, since strong action on climate change likely requires the collective effort of a wide swath of actors concerned with civic justice, it is strategically valuable not to separate actions that seek to address global environmental injustices as they pertain to climate change from efforts to address issues of local environmental injustice as they pertain to air quality. At the same time, the need to pass

additional legislation potentially (see below), makes the task of passing climate change legislation more difficult, thereby possibly compromising goals on international climate justice, which are of central concern to Oxfam. There is no neat answer to this challenging strategic question, and its resolution likely lies in close coordination with local partners and open dialogue about the strategic challenges and opportunities within the legislative space on climate change. At a minimum, carbon pricing policy should include mandating the deployment of air quality sensors to ensure worsening air quality among low-income populations is not an outcome of the policy and that remedial action can be taken if necessary.

REGRESSIVITY: SOCIAL NORMS

Finally, regarding the third element of regressive carbon pricing mentioned above: that it derives from social norms (e.g., class, gender, race, etc.) that disproportionately expose certain groups to increased prices for carbon-intensive goods, as they have reduced options to adopt low-carbon behaviors/technologies. Evidence on the exact extent to which this is happening in terms of gender is lacking due to a lack of gender-disaggregated data and due to the challenges of observing differential energy consumption and financial autonomy within the household (Chalifour 2010). Further, as above, it is argued that revenues from the carbon price can be used to address these distributional impacts. Likewise, policy design and complimentary investments (e.g., in public transport) can also be used to minimize such impacts (Chalifour 2010). However, the need for effective policy design to mitigate risks of regressive policies raises the risk that policy will be poorly designed. This argument can be applied to most policy, including most regulatory and standard-setting efforts.

INCREMENTALITY

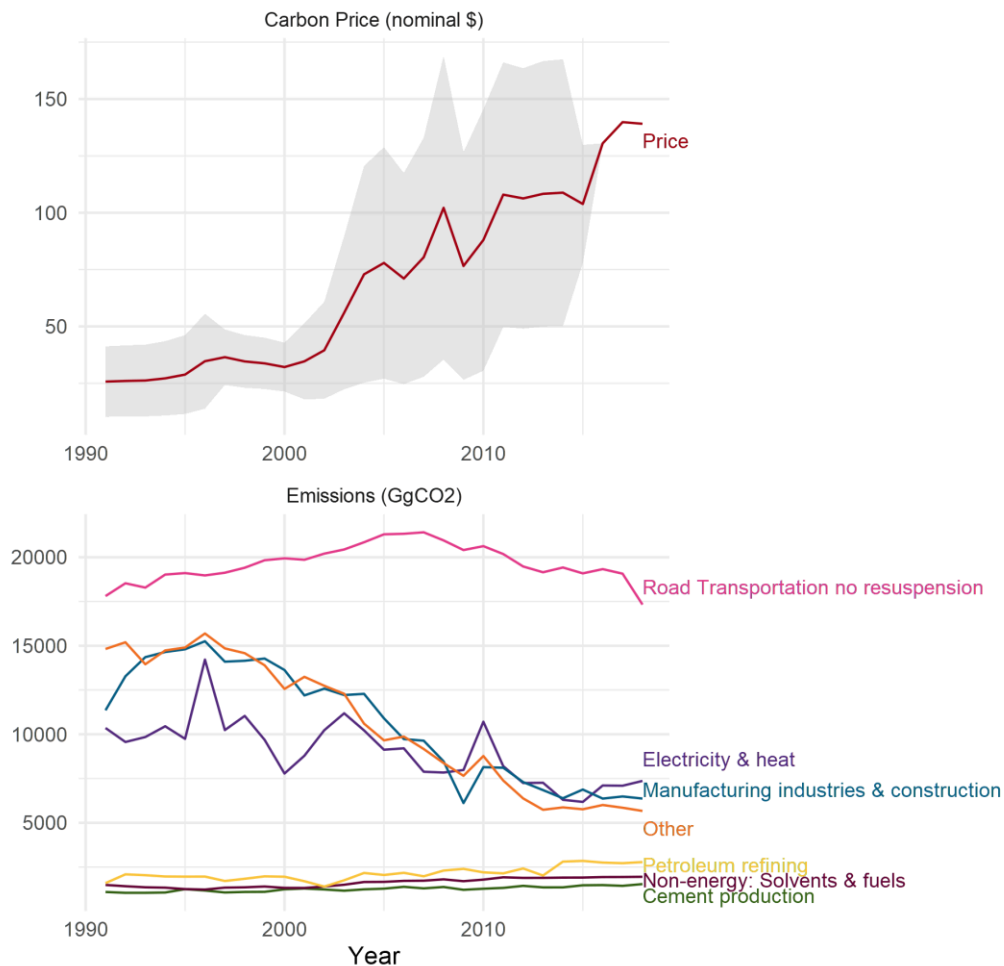
Turning to the second issue: carbon pricing is unsuitable as a policy for addressing climate change because it is an incremental approach and there is no time for incrementalism (Mildenberger and Stokes 2020; Green 2020; Tvinnereim and Mehling 2018). While it is true that carbon pricing has sought an incremental approach, in which prices and coverage start at relatively low levels with the stated plan to raise them over time, this incremental approach is generally used for reasons of political palatability. However, the policy need not be incremental. It is quite possible that prices could be introduced at high rates or under more stringent caps. Doing so would drive substantial emissions reductions. Such a response, of course, centers debate on the political palatability of carbon pricing. Separating the political challenges from theoretical debates about carbon pricing

is not intended to diminish such challenges, but rather to focus on them. These political challenges are discussed in greater detail below.

INADEQUACY (CARBON PRICING DOES NOT FOCUS ON KEEPING FOSSIL FUELS IN THE GROUND)

Third, carbon pricing is inadequate because it does not go after the root of the problem, which is the burning of fossil fuels (Gilbertson 2017). The exact logic behind this argument can be hard to discern. Essentially carbon pricing goes after demand for fossil fuels, which will undermine the reason for their extraction. That said, one potential interpretation of this argument is that prices are inadequate as a means for reducing demand, because demand for fossil fuels only weakly responds to increased prices (Mildenberger and Stokes 2020; Tvinnereim and Mehling 2018). There is certainly merit to this argument; see empirical section above. Further, Boyce (2018) points to a meta-analysis of empirical estimates of the price elasticity of energy demand (based on hundreds of studies between 1990–2016) that found an average short-run elasticity of 0.21, and a long-run elasticity of 0.61.²⁷ As a result, prices would have to get very high indeed to drive emissions down at the rate necessary to address climate change (though these numbers are expected to improve as abatement costs decline). This challenge is most clearly demonstrated in Sweden where, despite the country being one of the few in the world with a substantial carbon price, emissions from the vehicle sector have remained stubbornly high, even with the price focused on the transport sector (note the studies above that suggest evidence on the impact of the price is mixed). See Figure 6.

²⁷ This finding means that a 10 percent increase in energy prices, resulted in only a 2.1 percent/6.1 percent decline in energy demand over the short/long term.



Note: Ribbon on carbon price reflects different pricing for different sectors
 Source: World Bank and EDGAR (updated 2021-07-15).

Figure 6. Trends in carbon pricing and emission-based sectors in Sweden.
 Showing that even at high prices the impact of carbon pricing on certain sectors can be limited. Source: Author.

While issues of price inelasticity are real, several points are worth noting. First, low price inelasticity does not mean a price will not work. It just means prices will have to get very high to make a difference, perhaps much higher than is currently being achieved in Sweden (even then, such price increases are still expected to be the cheapest pathway to reducing emissions – see theoretical section above). Second, if one uses a cap rather than a tax, then one is addressing fossil fuel extraction by limiting how much CO₂ can be emitted, and therefore the scope for extracting it. Under a tight cap, we would see emissions decline so long as the cap was enforced. The obvious outcome is that we would also see energy prices get extremely high, effectively as high as would be necessary to cover the cost of switching to alternatives. It is fully acknowledged that in both cases such high prices would likely drive political opposition, which would result in lower taxes, an

expanded cap, or the adoption of a hybrid model. Again, however, this issue is one of how to make carbon pricing politically palatable. It is not an issue with the pricing mechanism itself. Second, it should be recalled that most arguments for carbon pricing argue that complementary policies and investments will be necessary, both to address other market failures (such as underinvestment in public transport and R&D into low emissions alternatives, due to their positive externalities) and to address the fact that some sectors (transport being a notable one) do not involve rational decision-making on the basis of cost minimization alone (see above). So while low levels of price inelasticity (which themselves derive from a lack of cheap alternatives to fossil fuels) present a substantial challenge to emissions pricing, they do not appear to invalidate the theory underlying carbon pricing, though they do raise the challenge of making high prices politically palatable and highlight the need for complimentary investments (Tvinnereim and Mehling 2018).

POOR POLITICS

The fourth, and possibly most substantial, objection to carbon pricing is that the preponderance of low prices and insufficient coverage is not just a temporary issue. Rather it is an inevitability of emissions pricing due to the uniquely bad politics of the approach (Roberts 2020; Mildemberger and Stokes 2020; Green 2021; 2020; Cullenward and Victor 2020). The unique political failings of a carbon price are argued to be numerous.

First, an emissions price is the most transparent way to reveal the costs of addressing climate change. Rather than, say, invoking a fuel efficiency standard and hiding the costs in the increased price for new vehicles, a carbon price makes very clear the exact cost the public is paying in the fight to address climate change, as the tax or permit value is openly observable in the market price (Stavins 2020; Green 2020). This visibility makes such pricing an easy object for public discontent. Likewise, it makes objections to increasing prices/coverage a simple target for elected officials opposed to pricing.

Second, because part of carbon pricing's attraction is its applicability to the whole economy as a single policy to make large gains on climate change, it gives opponents of a price a single point of opposition around which to coalesce. This feature effectively serves to unite otherwise disparate opponents of a price, thereby making a price harder to pass (Roberts 2020; Mildemberger and Stokes 2020).

Third, and relatedly, the effort to bring such a wide array of actors on board behind a single (carbon pricing) policy results in carbon pricing tending towards the lowest common denominator, which is essentially a low price with limited coverage (Cullenward and Victor 2020).

Fourth, the notion of a price offers little that is discursively compelling, forcing people to focus on what they will have to give up in order to address climate change (Mildenberger and Stokes 2020). This approach is in contrast to an approach that is, for example, focused on green investment. Green investment focuses people on solutions and opportunities and might, in fact, first be necessary to gain the political will for a carbon price (Biber, Kelsey, and Meckling 2016). Further, policies focused on incentivizing investments (such as subsidies) are thought to be potentially more effective, as they create economic interest groups that increase the durability and level of entrenchment of a policy (Biber, Kelsey, and Meckling 2016).

These four issues are argued to result in inevitably low prices and limited coverage, thereby damning emissions pricing. In this context, a notable further complaint about carbon pricing is that its existence, even at insufficiently low levels, undermines public appetite for further action, as people form the opinion that carbon pricing is a sufficient solution. The result is an account of carbon pricing as an inevitably flawed policy that distracts from the policies necessary to address climate change.

While the above points are all extremely serious and no complete rebuttal of them could possibly be offered, it is worth articulating several counterpoints. - -

- First, the problematic transparency of carbon pricing could plausibly be offset by the payment of a highly transparent dividend.
- Second, the idea that the cross-sectoral relevance of carbon pricing results in a coalescence of opposition is quite possibly true. However, the corollary must also be true: carbon pricing results in a point of coalescence around which supporters of climate action can congregate.
- Third, while it is clearly true that carbon pricing has not been able to recruit sufficient political support to achieve the prices and coverage necessary to limit emissions at a suitably rapid rate, it also must be stated that it is not evident that there is manifest support for the myriad policies that would be necessary to address climate change through other measures. Efforts to, among other things, pass a budget that allows for trillions of dollars of public investment for renewable energy, bans the sale of internal combustion engines, or outlaws fossil fuel extraction are all likely to be met with significant political opposition (and possibly constitutional challenges). At the same time, one should be cautious of dismissing the political palatability argument too quickly, as there is some evidence suggesting that there is greater public support for policies framed around subsidies and public expenditure (Biber, Kelsey, and Meckling 2016). On top of such issues, an approach that relies on myriad policies is surely equally at risk of losing public support on the grounds that the public believe that one of the multiple measures in place undermines the need for further policy.

- Finally, it should be noted that, even if one hides the costs of a low-carbon transition in legislation dictating standards or regulating emissions-related activity, these costs will eventually make their way to the consumer. Given the scale of the costs involved in addressing climate change (which are illustrated by the high prices that would be necessary to make carbon pricing work) and the fact that a regulatory and standard-setting approach is likely to be more expensive than a price-based approach, these costs will have manifest impacts on people's well-being, which can be expected to drive opposition. A regulatory and standard-setting approach, unlike a carbon price approach, means there is not a clear revenue source for addressing the regressive impacts, other than arguing for further public financial support (as is the solution proposed by Mildenerger and Stokes (2020)). One might assume arguing for further public financial support would further strain political support.

Fundamentally, while political opposition is clearly a huge obstacle to carbon pricing, it's not clear that this opposition is unique to pricing efforts.

The most forceful counter to the above set of arguments is the idea that most of the work being done on emissions reduction is the result of non-pricing measures (Roberts 2020; Green 2021). In this argument, the political advantages of non-pricing measures are simply revealed by the fact that more CO₂ is being abated under measures other than carbon pricing. For example, the California ETS cannot get prices above \$18 (World Bank 2021), yet the state can institute a renewable energy portfolio standard, a low-carbon fuel standard, and an advanced clean cars program. Likewise, the US cannot pass a carbon price but can pass fuel efficiency standards and can advance a clean power plan. The counter to this (counter) point is argued in the empirical section above. First, finding an answer to whether non-pricing policies are actually doing more work than prices is hard to determine because of the data limitations and methodological challenges involved in untangling all the factors driving emissions. Second, based on the literature consulted here, what evidence there is appears inconclusive. It should also be recalled that non-pricing emissions reduction actions have not been passed by the US Congress. Thus it is not clear that they really are less politically unpalatable than carbon pricing, at least at the national level.

Since it is not clear how much abatement can be achieved without congressional action, the pointed question is which approach will be more acceptable: an effective price or an array of effective policies and regulations? While the answer to this question seems to be unclear, it is certainly true that climate regulation should go where the momentum is. There is likely little value in pursuing carbon pricing, if it turns out that legislative progress is being made elsewhere (and vice versa). It is also further not clear that this debate need be set up as an either/or one. As mentioned above, the economic theory on carbon pricing routinely states

that carbon pricing alone will not be sufficient to drive sufficiently aggressive action on climate change. Thus, pricing carbon and pursuing massive investment in public goods should be seen as complementary, rather than opposing, strategies.

AN INSUFFICIENTLY TRANSFORMATIVE SOLUTION

A final argument that is levelled against carbon pricing is that it represents a wholly inadequate solution to the problem of climate change, which is not an issue of externalities or common property but an inevitable outcome of the fundamental contradictions of capitalism (Gilbertson 2017). Specifically, capitalism requires the exploitation of both labor and nature to sustain itself. This exploitation renders capitalism reliant on growth in the short term, and unsustainable in the long term. In this conception, carbon pricing does not represent a potential solution to climate change. Rather, it reflects the trend in capitalism to resolve its crises by expanding the scope of commodification to create new sites of growth and accumulation. Much worse than a solution, carbon pricing is a band-aid stretched over the ever-growing crises of capitalism, which forebear greater catastrophes, as crises of biodiversity and other planetary boundaries loom large on the horizon. Climate change is then a symptom of the larger systemic problem that is capitalism.

A related argument pertains to the damaging nature of commodification, which, by rendering the environment in increasingly transactional terms, debases our relationship with it. The argument tends to be articulated in broad terms, but the concern is that such commodification stands to transform the environment from a symbolic arena of connection, stewardship, common property, and even the sublime (Cronon 1996) into a realm of individualized transactional incentives (Sandel and Anne 2012). While the exact implications of such a transformation are challenging to articulate, the latent concern is that it will reconfigure our relationship to the environment in ways that will thwart the human experience, make addressing other ecological and social challenges more difficult, and may even undermine our capacity to address climate change.

The above argument is difficult to challenge, as it is based in a theoretical account of materialist political economy and critical political ecology. A lack of clear refutability does not diminish the significance of the concerns raised. Much of the global economy is organized around a private market for capital, and the pursuit of maximum future returns ties the global system to an inexorable pursuit of growth that will eventually clash with the finite resources available on the planet. On the other hand, it must be said that the total available resources on the planet are significant, and people have previously been wrong about how close we are to ecological limits, having underestimated the possibility for

technological advances as well as the scope of human adaptability. Further, while carbon pricing may be a band-aid, no alternatives to the capitalist system are readily available, and certainly none are reconfiguring our relationship with the material world sufficiently to suggest an imminent solution to the rapid onset of dangerous climate change²⁸. In summary, even the strongest proponent of carbon pricing should be concerned about the long-term challenges capitalism poses to sustainability. At the same time, limiting our set of solutions to climate change to only those that can address all the ills of modern capitalism is likely untenable.

The above arguments against carbon pricing are substantial and should be taken seriously. At the same time, addressing climate change will be extremely difficult. It is not clear that the alternatives contained within these arguments are immune to the political challenges faced by emissions pricing. Further, the primary objection to carbon pricing as a strategic policy priority is that prices will have to be too high to be palatable, yet it must be remembered that alternative approaches are likely to result in higher costs. These approaches will likely meet political opposition also. Overall, for the purposes of Oxfam's engagement on this issue, it is suggested that the takeaways be as follows:

- If carbon pricing is to work, prices need to be at a high-enough level and of a sufficient price to drive emissions reductions;
- if carbon pricing is to start low for political palatability's sake, guaranteed means to aggressively ratchet prices/coverage need to be in place;
- carbon pricing requires substantial complimentary policies, both to address market failures and to account for failings in the model of rational utility-maximizing consumers;
- any effort at carbon pricing needs to place a similar priority on addressing related environmental justice concerns;
- any carbon pricing policy needs to be closely attuned to issues of regressivity, including both direct economic effects and effects that result from social norms deriving from social and material constructs around race, class, gender, etc.;
- whether or not carbon pricing sees successful adoption, society should be deeply concerned about the unsustainability of capitalism and the urgent need to envision alternative modes of production;

²⁸ As a relevant aside it should be noted that some authors have argued that a cap-and-dividend approach constitutes a break with prior economic arrangements by framing the climate in terms of "universal property" on the grounds that the atmosphere's ability to absorb CO₂ should be viewed as individual, inalienable, and equally held by all (Boyce 2019; 2020)

- ideological commitments to carbon pricing or other policies are unwise. Effort should be placed on where the momentum is currently, and all avenues should be pursued in order to address climate change.

Based on the degree to which issues of political palatability dominate concerns over the realization of carbon pricing, the next section of the paper moves to discuss what is understood of the possibility to improve the political palatability of pricing mechanisms.

ADDRESSING THE UNACCEPTABILITY OF CARBON PRICING

KEY MESSAGES

- Literature focused on improving the political palatability of carbon pricing suggests that the most salient interventions revolve around explicit design and active communications.
- In terms of design, there is thought to be limited public interest in grandfathering or tax-shifting, revenue-neutral approaches, though this limited public interest likely varies based on the culturally produced world views of the constituents where the policy is being proposed.
- In terms of design, transparent dividends to low-income households and earmarked expenditure on other low-carbon investments show the greatest levels of acceptance.
- The political economy of carbon pricing is hard to assess in the US based on the significant degree of partisanship in the legislature.
- Opinion data are likely to prove a valuable data point for any political economy analysis. However, such views appear to vary in time and space, and robust analysis should be undertaken closer to the launch of any campaign/policy ask.

The overwhelming argument against carbon pricing is that its lack of political palatability is a major impediment to wider uptake, expanded sectoral coverage, and the use of higher prices. This impediment is categorically evidenced by the description of the status of carbon pricing initiatives provided above. As such, should Oxfam choose to engage with carbon pricing, a central concern should be on design considerations that can advance the political palatability of any pricing effort. This section of the report describes literature that considers this specific issue. It further provides a brief overview of the political economy of carbon pricing in the US.

IMPROVING THE POLITICAL PALATABILITY OF CARBON PRICING

Reflecting the overarching point made above, that the differences between emissions trading and a carbon tax are less important than the specifics of how any initiative is designed, writing on issues of political palatability tend to focus on issues of design and communication. In terms of design, the primary focus is on: i) the rate at which pricing is adopted; ii) concerns about grandfathering; and iii) the way revenues are used.

Regarding i) the speed at which pricing is adopted, it has been argued that phasing in pricing slowly can be advantageous. The theory here is that people are likely to be initially resistant to pricing. Once prices are in place, revenues are flowing, and emissions are being abated, attitudes will change, allowing for more-ambitious pricing (Carattini, Carvalho, and Fankhauser 2017). Notable concerns with this approach are that, first, price uncertainty can undermine business investment in new infrastructure and R&D, slowing progress on emissions reduction. Second, there is a very significant risk that prices will get frozen at too low a rate to induce emissions reductions at the scale necessary, as is evidenced by the real-world experience with carbon pricing. It is proposed that one way around this problem might be to include mechanisms to ratchet prices over time (Carattini, Carvalho, and Fankhauser 2017). However, one would imagine that this strategy would drive the same resistance among skeptics of emissions pricing as would starting at a higher price.

In terms of grandfathering, there has been some suggestion that grandfathering of permits can be used to gain political will among well-formed anti-pricing lobbies (Aldy 2017). However, this approach has received substantial push-back. First, there is concern that since grandfathering creates windfalls, firms will be incentivized to spend more on attaining rents (lobbying, etc.) than on the investments needed to lower emissions (Cramton and Kerr 2002). Further, grandfathering permits create a perverse incentive for firms to maintain higher-than-necessary marginal abatement costs, as doing so maintains the likelihood of keeping access to grandfathered permits (Cramton and Kerr 2002). Finally, since grandfathering does nothing to keep prices down and leads to corporate windfalls, it is possible that their existence stands to undermine public acceptance of an emissions price (Mildenberger and Stokes 2020). In general, it is thought that grandfathering is an unwise strategy for inducing political support for emissions trading (Stavins 2020; Goulder and Schein 2013).

In terms of ii) revenue use, Carattini, Carvalho, and Fankhauser (2017), in their review of works gauging the social acceptability of different policies, argue that there is evidence for a number of practices that will increase the political acceptance of an emissions price. These include:

1. Have a clear and explicit plan for revenue use, as well as transparent reporting for accountability purposes. Having a clear plan and transparent reporting are believed to be important for advancing public trust in any initiative;
2. earmark revenues for investment in low-carbon technologies. Doing so is believed to be important for addressing concerns that prices alone won't induce reductions in emissions, as well as public mistrust in the state's capacity to use revenues effectively;
3. use taxes to address the regressive nature of an emissions price on low-income households. Using taxes in this way is believed to be important for the price to be socially acceptable;
4. cut other taxes, i.e., revenue neutrality. Note that cutting other taxes is thought to receive the least public support, when compared to 2 and 3 above. That said, it is the preferred option for many economists because of the "double dividend" described above.

Regarding 2 and 3 above, Carattini, Carvalho, and Fankhauser (2017) argue that the preponderance of evidence shows a slight preference for earmarking over revenue recycling. They note that that it could be possible over time to increase spending to address the distributional impacts of the price, once the need for earmarked investments declines. They note that, as per point 1 above, such an approach would require a clear communications strategy to articulate exactly what revenues will be used for. They also note that the desire for earmarking can be reduced in cases where the impact of pricing on reducing emissions can be clearly demonstrated (Carattini, Carvalho, and Fankhauser 2017). In addition to these general principles, Aldy (2017) argues that, in cases where some sort of dividend will be available, there is value in paying part of that in advance of the tax being implemented so that people can appreciate the impact it will have on their household.

Regarding clear communications, the aim is to address concerns about pricing, such as its lack of impacts on emissions, regressive nature, and the risk of irresponsible use of revenues. Essentially, clear and effective communications should include: anticipated emissions reductions; expected co-benefits; price issues (including who they will be applied to, how they will be raised, and how they might vary); scale of revenues; plans for revenue use; and impacts on the economy and low-income households. In addition, communications should involve detailing transparency, accountability, and reporting standards. All these efforts are thought essential to creating and maintaining public support for an emissions price, as well as creating public appetite for more expansive pricing. Notably, communications of this sort are anticipated to require a plan and strategy from the outset, rather than be an afterthought or to simply result from

the publication of technical reporting documents (Carattini, Carvalho, and Fankhauser 2017).

The above findings are echoed in large part by Klenert and Hepburn (2018) who, building on recent insights from behavioral and political sciences, observe that framings on the use of revenues are core to advancing the political acceptability of carbon pricing. Specifically, they find that: i) willingness to pay for climate change mitigation is largely a function of political, economic, and cultural world views; that is, the public is skeptical of policy solutions if they contradict underlying ideological predispositions; ii) directing revenues towards earmarked climate-friendly expenditure or to compensate disadvantaged households proves more popular than seeking any double dividend; iii) relabeling carbon pricing, for example, as a “CO₂ levy” or “carbon and dividend” can improve acceptability compared to “carbon pricing;” and iv) visible revenue recycling—say, dividends to households rather than tax cuts—increases acceptability. Further, they find that political science suggests that: i) ambitious pricing tends to be correlated with high levels of political trust and low levels of corruption; and ii) policy is more likely to be successful if its costs are diffused and its benefits are centralized (notably the opposite of carbon pricing) (Klenert and Hepburn 2018). One outcome of the finding that the political acceptability of carbon pricing is a function of world views is that in different contexts, different approaches might be more or less relevant. For example, where inequality concerns dominate, revenues should be transferred in a lump sum to the lowest-income populations, while in contexts where center-right world views dominate or where trust in government is low, budget-neutral strategies such as tax cuts might be more acceptable (Klenert and Hepburn 2018). Overall, Klenert and Hepburn (2018) argue that issues of acceptability should be paramount, with concerns around equity and efficiency being second-order concerns. Such a finding is likely to challenge Oxfam, whose focus is much more geared towards equity and inclusion rather than on efficacy first and foremost.

While the conversation above is oriented at improving the political acceptance of carbon pricing, it is effectively an apolitical discussion, working from the assumption that the challenge of policy implementation is simply a matter of technical design. In reality, of course, policy design is a political enterprise. In this respect, there are few general accounts that can be offered, as the politics of climate change and emissions pricing is context specific (and rapidly changing). Nonetheless, the report turns briefly to offer reflections on the specific political economy of carbon pricing within the US.

POLITICAL ECONOMY OF CARBON PRICING IN THE US

Brooks and Keohane (2020) offer a useful starting point for discussing the likelihood of realizing a carbon price in the US, arguing that, due to the current level of partisanship in the US, it is generally impossible to accurately determine congressional appetite for an emissions price. With this caveat in mind, they go on to identify evidence of what they observe to be a modest increase in interest in carbon pricing since the first cap-and-trade legislation failed in 2010. This increase in interest is evidenced by: new advocacy groups joining environmental NGOs in pursuing a price; private companies, including some oil companies, now supporting a price (at the time of writing this report, a number of industry associations, including the US Chamber of Commerce and the American Petroleum Institute, had come out in support of a price); Bernie Sanders including a carbon price as part of his 2016 campaign platform; the introduction of a Republican-backed carbon price in the form of the Market Choice Act (2018) and the bipartisan Energy Innovation and Carbon Dividend Act (2018); and the prioritization of climate within Democratic politics in the 2020 election cycle (Brooks and Keohane 2020).

In discussions of interest in emissions pricing in the US, a common point is that differences in uncertainty over emissions under a tax and price under a cap tend to dominate the political landscape (Weitzman 2014; Stavins 2020; Aldy 2017; Brooks and Keohane 2020; Goulder and Schein 2013). This framing conceives the determinants of carbon pricing as the outcome of pressure from environmental groups and the business lobby. The former leans towards certainty over emissions, while the latter is more interested in certainty over prices. Notably, however, these groups are not thought to be monolithic. Business interests include actors lobbying against a price on the grounds that it will limit demand for their goods, as well as actors lobbying in favor of a price as it will afford them a comparative advantage moving forward. The same can be said of environmental groups, where new coalitions are linking large environmental NGOs, anti-fossil fuel groups, grassroots activists, and environmental justice groups. At the same time, some of these actors (especially those concerned with environmental justice) are more skeptical of market mechanisms to address emissions. They place a greater focus on limiting point source emissions that are associated with issues of local pollution and health impacts that are the long-standing concerns of environmental justice advocates (Brooks and Keohane 2020; Fowlie, Walker, and Wooley 2020). The recent increased focus on issues of racial justice in the US and the long-standing focus within these groups on issues of environmental justice appear to have made a major dent in Democratic consensus on the need for a carbon price. This is most clearly evidenced by the lack of mention of carbon pricing within the flagship progressive legislative package pertaining climate change, The Green New Deal

(Stavins 2020) and the limited engagement on carbon pricing by President Joe Biden.

In a context of legislative deadlock, it is thought that any progress on emissions pricing would take the form of an upstream tax. This upstream tax is notably in contrast to the Waxman-Markey Bill from 2009 and the successful pricing of emissions in 11 US states, which use emissions trading (Brooks and Keohane 2020). The argument for why a tax might win out is that, under such a set-up, revenues could be recycled using only financial committees. In the case of emissions trading, it would be necessary to give environmental committees financial capacities, which would require specific legislation (Stavins 2020). Further, as Keohane and Brooks (2020) point out, most of the recent legislative activity on emissions pricing in the US has taken the form of a carbon tax. One counter to the idea of preference for a tax was that the notion of “taxing” carbon would be less palatable to voters than the proposition for “trading” it. However, this argument has been undermined by the degree to which the Waxman-Markey cap-and-trade bill was effectively reframed by opponents as “cap and tax” (Broder 2010; Stavins 2020).

Regardless of whether a tax or cap-and-trade mechanism is a more likely possibility for national carbon pricing in the US, for reasons laid out above, the likely outcome is a hybrid mechanism (Brooks and Keohane 2020; Stavins 2020). Given concerns about the failure of mechanisms to use sufficiently high prices or cover a sufficiently large number of sectors, it is considered extremely important that a target-based mechanism for adjusting prices, coverage, and caps and/or collars is established so as to ensure pricing is sufficient to induce the necessary emissions reductions (Brooks and Keohane 2020).

A final point of political economic contention within the US that is pointed out by Brooks and Keohane (2020) pertains to potential interactions between any national emissions pricing scheme with the Clean Air Act and its authorization by the Environmental Protection Agency (EPA) in regulating GHGs. The significant authority afforded the EPA is evidenced by the difficulties the Trump administration had in rolling back regulations put in place by the Obama administration. While rules were eventually rescinded, the authority of the EPA remains intact. As such, it is thought that future Democratic administrations would be able to drive GHG regulation via the EPA. In this context, Brooks and Keohane (2020) point out that some authors have proposed a trade: removal of the EPA’s statutory authority to address GHG emissions for an emissions pricing scheme (or some other climate policy). The point Brooks and Keohane (2020) make is that any such deal (which has notably met with strident resistance from environmental advocates) would only be rationally acceptable if the policy offered, at least, what the Clean Air Act would currently make possible on GHG regulation. For them, this would necessitate the inclusion of quality mechanisms to ensure that any pricing mechanism responds to emissions reduction targets in

a rational manner and without the scope for political deadlock to halt increases in the coverage and price of a mechanism over time (Brooks and Keohane 2020).

In addition to the reflecting on the broad political machinery surrounding any potential deal on a carbon price, a salient datapoint would come from an analysis of opinions based on polling data on carbon pricing. Such opinions vary in both time and space. They are likely to change going forward (see Figure 7 below). Since it is unlikely that Oxfam America will adopt any campaign or policy ask on carbon pricing in the very short term, it is thought more relevant to suggest that such an analysis take place prior to any decision on a campaign or policy ask.

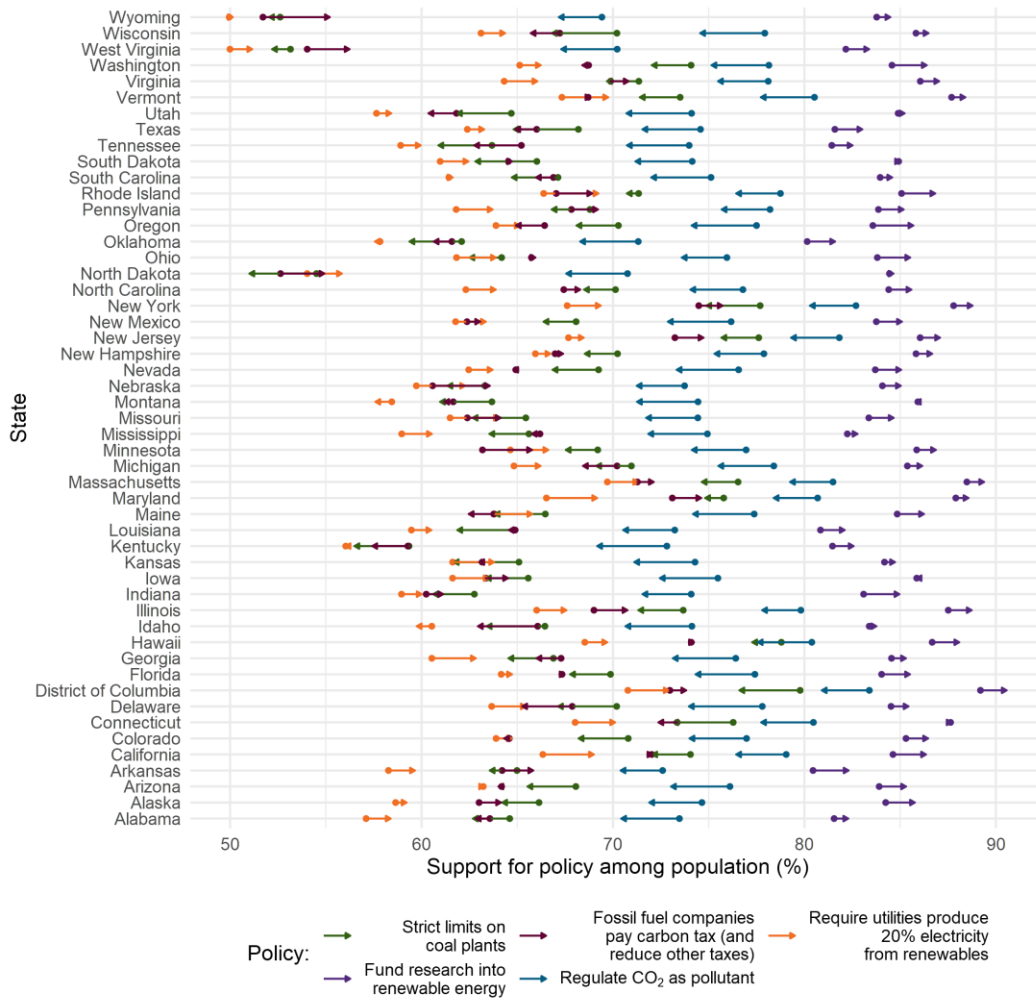


Figure 7. Support for different climate policies. Arrows reflect the size and direction of change between 2018-2020. Showing that support for climate policies is variable and changing. Source: Author.

CONCLUSIONS

This report has sought to review the literature on carbon pricing to outline the most salient considerations for Oxfam. As stated in the introduction, the aims of the report are not to induce Oxfam to adopt a specific policy or position on carbon pricing nor to raise the issue as a strategic focus. Rather, it is to provide a strong basis for any strategy-making around this issue, so that decisions can be made on an informed basis with a robust understanding of the implications should the organization choose to support any particular policy.

Primary takeaways from the report are as follows. First, the primary theoretical advantage of carbon pricing, compared to other approaches to addressing climate change, is its ability to achieve a least-cost approach to addressing climate change. The extent to which this concern is a primary one for Oxfam is a separate matter. It is thought to be salient given the scale of the costs involved in transforming the structure of the global economy so profoundly.

Second, while carbon taxes and a cap on carbon might, at first, seem like quite different policies, the likely dominance of a hybrid approach (necessary to address politically unpalatable elements of both a tax and cap) means that the two policies are more similar than they are different. As a result, issues of the specific design of any pricing scheme are more important than the choice between different potential mechanisms.

Third, although there are a significant number of design details that matter, there are two that are likely of most importance to Oxfam. The first pertains to ensuring the price is high enough, and applied to a sufficiently large number of sectors, to achieve emissions reductions on the scale necessary to galvanize action on climate change. The second pertains to ensuring that plans for revenue use are such that they can account for the likely regressive use-side effects of a price. It is worth noting that experience with carbon pricing to date suggests that issues of regressivity have not been suitably prioritized and that prices have been insufficiently high and applied to an inadequately small number of sectors to achieve sufficiently aggressive emissions reductions.

Fourth, even if carbon pricing is adopted as a policy priority for Oxfam, it is essential to appreciate that other policies will also be required to: a) overcome other market failures impeding an efficient transition to a low-carbon economy; b) address failings in the microeconomic assumption that consumer decisions are driven solely by a desire for cost minimization; c) account for indirect regressive impacts of a carbon price; and d) advance goals that are equally important to Oxfam and tied to concerns about racial justice and the long-term unsustainability of capitalism.

Finally, it should be noted that it is fundamentally unclear whether the political obstacles that carbon pricing faces are unique to the policy, thus rendering it a dead end, or whether they are generalizable to all climate policy. Certainly, there is no value in adhering to carbon pricing on ideological terms. Oxfam should both go where the energy is on policy and avoid putting all its eggs in a single policy basket.

ANNEX A. AUCTIONS

Under emissions trading, if one is not going to grandfather permits, one has to sell them. The question then becomes one of how to work out the price at which they should be sold (notably, even if some permits are to be grandfathered, auctions of the remaining permits can still be useful for price discovery). Since permits have not been sold before, the price of emissions under the cap must be discovered. There is wide agreement in the literature that the most effective means for discovering the price is an auction, though the specifics of which auction design is best have not been fully resolved.

Broadly, auction design can be divided along two orthogonal vectors (see Figure A.1.), defined by 1) how you submit your bid: either a) as a single submission or b) via multiple increasing bids (also called an “ascending” or “clock auction”); and 2) what you pay: either a) the price you bid or b) a uniform price that is paid by everyone. A description of the broad outlines of each of these approaches follows (Cramton and Kerr 2002, Lopomo et al. 2011).



Figure A.1. Representing typology of auction designs based on orthogonal vectors. What you pay (y-axis) vs. how you submit your bid (x-axis).

Under 1a) single submission, every bidder simultaneously submits a bid consisting of the number of permits they want and the price they are willing to pay for those permits. Bids are sealed and only known to the individual bidding party. The total quantity of permits sought by the bids is then totaled, in descending order of bid price. Once the quantity of permits submitted in the bids equals or exceeds the quantity of permits available, the market “clears” and the price is set (the “clearing price”) according to the bid that caused the total requested permits to exceed what was available. All bidders who submitted bids above the clearing price receive the number of permits they submitted (with the last bid being rationed to what is left of the available permits).

The price one pays for these permits depends on whether the auction is based on 2a) “pay as bid” or 2b) “uniform price.” Under pay as bid, everyone who submitted at, or above, the clearing price pays the amount they bid. Under a “uniform price,” everyone pays the clearing price, regardless of what they bid. In both cases, any remaining permits are rationed to the bidder who submitted bids at the clearing price.

Under 1b) dynamic or ascending auctions, the auction undergoes rounds in which the price is stated and then repeatedly raised. Each time the price is stated, participants submit the quantity of emissions permits they would be willing to buy at the stated price. The starting price is usually so low as to induce bidders to submit for more permits than are available. As the price rises, fewer and fewer permits are bought, until the number of permits submitted matches or exceeds the permits on offer. At that point permits are awarded, again on the basis of 2a) pay as bid or 2b) uniform price.

In terms of preferences for different auction formats, authors lean strongly towards 2b) uniform pricing (Cramton and Kerr 2002; Lopomo et al. 2011) and weakly towards 1a) single submission (Lopomo et al. 2011). The main reason for preferring uniform pricing is that under pay as bid, the aim of any bidder is to bid just above the clearing price, as doing so allows you to pay the least amount of money while still receiving all of the permits you sought. This outcome biases the system towards larger, established players who have knowledge of, and the capacity to do research on, factors that might reveal the clearing price for the market; for example, understanding the marginal abatement costs of other firms, and forecasting economic growth and fossil fuel prices for the upcoming period. Such an outcome raises barriers to entry, limits competition, and undermines innovation (Cramton and Kerr 2002; Lopomo et al. 2011).

Regarding whether single bid or ascending clock formats are preferable, the literature is more mixed. Proponents of multiple rounds suggest that they provide more information on the marginal cost of abatement, meaning the accurate price is more effectively discovered (Lopomo et al. 2011). On the other hand, single bid auctions are less complex as they do not require rules governing behavior between each round of bidding. Such rules are important to ensure that bidders only submit for smaller quantities of permits as the price rises (which is necessary to ensure that bidders don't hold back information and then increase their bid once others have revealed their information (Cramton and Kerr 2002)). Further, auctions with multiple rounds, in creating more information about the marginal price, also create more opportunities for the exchange of information, which can be used to drive collusion and price manipulation (Lopomo et al. 2011). Finally, it is thought that one can get around issues of limited information in the case of single bid auctions by allowing individual bidders to submit multiple bids on the condition that bids for higher quantities of permits are submitted at

lower prices. Doing so effectively reveals the marginal value of emission permits by creating a more complete cost curve.

A final prominent consideration for auction design is addressing what is known as the “winner’s curse.” The winner’s curse refers to the fact that for any uniform goods auction, the winners of the auction will be those bidders who make the most optimistic assessment of the value of the good. Since the true value of the good is likely to be less than the most optimistic valuation, the winner of the auction is cursed by the fact that they end up paying more for the good than it was worth. Because this outcome is known by bidders, they respond by deliberately bidding less aggressively on what they believe to be the value of the good (a term known as “bid shading”) (Cramton and Kerr 2002; Lopomo et al. 2011). Bid shading is not as relevant for CO₂ emissions as it is in other auctions, as the primary driver of the value of permits is the particular marginal abatement cost of the specific firm, which should be best understood by the firm placing their bid. Nonetheless, since dynamics about which there is general uncertainty affect the demand for carbon permits (such as future rates of economic growth or future fossil fuel prices), it is still the case that it is the actors who think economic growth and fossil fuel prices will be highest (and therefore think permits will be most in demand/expensive) who will end up winning the auction. Since the actual level of economic growth and fossil fuel price is anticipated to be closer to the average estimate of the bids, the winner will end up paying more for the permits than they are worth (Lopomo et al. 2011).

A simple solution to avoid bid shading is to use a “Vickery Auction” in which the clearing price is simply set as the next-highest value to that which cleared the market. Doing so accounts for the opportunity cost of not winning the auction and thus causes participants to bid at their true value, rather than to shade their bids.

Overall, auction design is strongly suggested to use uniform prices, with a weak inclination to use a single round approach, and account for bid shading.

ANNEX B. EMPIRICS

The specific studies reviewed as part of this analysis refer to 17 ex-post empirical studies on carbon pricing that were reviewed as a supplement to the review of systemic reviews, which were found to be remarkably sparse. The studies were identified by a Google Scholar search, combined with snowballing to identify particularly salient results. This review is not considered systematic, but rather is a good-faith effort to engage with the state of empirical literature on carbon pricing.

The specific studies reviewed here echo these findings. For example, Bayer and Aklin (2020) use a synthetic control approach to estimate that between 2008–2016 the EU ETS drove a decline in emissions of between 8.1 percent and 11.5 percent (1–1.4 percent per annum) in ETS-covered sectors (~3.8 percent of total emissions). Impacts were largest among large industrial polluters who produced 11.5 percent less CO₂ than they otherwise would have (Bayer and Aklin 2020). Dechezleprêtre et al. (2018) likewise examine the impact of the EU ETS between 2005–2012, using a matching methodology and difference in difference approach. They estimate the EU ETS drove a 10 percent reduction in emissions over the period (1.4 percent per annum). Impacts were largest in the chemicals, non-metallic mineral products, and electricity sectors. Notably, emissions reductions increased from 6 percent during the first phase of the EU ETS to 15 percent during the second phase. Based on this finding, they estimate that, had free allowances from the ETS been halved, emissions would have been reduced by 25 percent (Dechezleprêtre, Nachtigall, and Venmans 2018).

Andersson (2019) and Runst and Thonipara (2020) further confirm this sentiment, in the specific case of Sweden. Andersson (2019) uses a synthetic control approach to assess the impact of carbon price and Value Added Tax (VAT) on transportation fuel use in Sweden and finds an 11 percent reduction in use between 1990–2005 (0.73 percent per annum). This finding is in notable contrast to other works in Sweden, which show no impact of a carbon price. The explanation for this difference in findings is thought to be the choice of methods for creating the counterfactual and the extent to which non-regulated sectors are included or not in the assessment (including sectors that are not regulated smears out the impact of the regulation). An additional finding of Andersson's (2019) work is that gasoline demand is more responsive to carbon taxes than it is simply to price increases. This finding calls into question estimations of the effectiveness of a carbon tax based on estimates of price elasticity, with the suggestion that carbon pricing is more effective at reducing emissions.

Runst and Thonipara (2020) seek to understand the impact of the rapid increase in the carbon price in Sweden after 2001. They address problems in previous

studies (which they argue fail to exclude unregulated sectors) by focusing exclusively on the residential sector—for which exemptions are not possible, but for which only about a third of emissions come from fossil fuels. Using a difference in difference method with synthetic controls, they find robust negative causal effects of the carbon tax on emissions. Residential sector emissions were reduced by 200–800 kg of CO₂ per person per year (no percentage change per annum is offered). Adoption of heat pumps is identified as the primary driver of reduced emissions (Runst and Thonipara 2020).

Gugler, Haxhimusa, and Liebensteiner (2020) also identify the negative impact of carbon taxes on emissions, this time in the British power sector. Their study uses a regression discontinuity in time between 2012–2016, finding taxes were responsible for around 60 percent of the 40 percent reduction in emissions that took place during this period. This translates into a 26.2 percent reduction in emissions from the sector (6.5 percent per annum). Explanations derive from the tax driving a shift away from both coal and older (less efficient) gas-fired plants towards newer (more efficient) gas-fired plants. It is hypothesized that nuclear and hydro do not fill the gap created by reduced coal and old gas due to these sources already running at high utilization rates. Gugler, Haxhimusa, and Liebensteiner's (2020) findings are largely supported by an assessment from Ofgem (the British Energy Market regulator). They note that their results are both larger and smaller than other studies. In this respect, Gugler, Haxhimusa, and Liebensteiner (2020) consider their method to be superior for its capacity to capture power plants that exited the sector permanently and due to the effective construction of their synthetic control group that does a better job of addressing confounding variables (Gugler, Haxhimusa, and Liebensteiner 2020).

Wang, Gao, and Dai (2019) find more moderate impacts in China. They use propensity score matching and difference in difference to estimate the causal impact of the Chinese ETS pilot between 2013–2016, in 30 administrative provinces where the pilot is being trialed. They find reduced real (7.6 percent) and nominal (12 percent) CO₂ intensities but find no significant impact on reducing overall emissions. The driver of reduced emissions intensity results from a reduction of coal in the energy mix; specifically, the proportion of coal in the energy mix was reduced by 28 percent. The findings are considered notable for demonstrating impacts of a carbon price in a more centrally controlled economy, where responsiveness to price signals is hypothesized to be dampened (Wang, Gao, and Dai 2019).

Shen, Tang, and Zeng (2020) confirm the relatively small effects in China. Using propensity score matching and difference in difference approach on firm-level data, they conclude that the ETS does encourage emissions reductions, but that the effect is relatively weak, with effects being largest in smaller, non-state-owned firms. They attribute the limited reductions to the degree of grandfathering in the Chinese pilot system. Further, the limited impacts among government-

owned firms are explained in terms of these firms not being so sensitive to prices, due to their political backing. This lack of sensitivity to prices is a major challenge for the ETS in China, where large state-owned firms contribute most to overall emissions (Shen, Tang, and Zeng 2020).

Findings on the relatively small effects of carbon pricing in sectors that require technological transformation (e.g., transport) has caused some authors to query whether carbon pricing can drive investments in innovation or whether impacts are limited to marginal gains based on efficiency and fuel switching (Green 2021). In the single systematic review that asked this question, Teixidó, Verde, and Nicolli's (2019) review of 22²⁹ papers concluded that the early phases of the EU ETS have been better at stimulating low-carbon innovation than they have been at driving low-carbon adoption, confirming the idea that most reductions under the ETS have stemmed from fuel switching and the optimization of energy use. They point to the impact of free allowances in placing a break on investments in innovation. Importantly, this impact suggests that firms undervalue their free allowances, failing to fully realize the economic theory that suggests that free allowances will result equally in cost passthrough. Teixidó, Verde, and Nicolli (2019) highlight that a major limitation of their review is the lack of analysis of the third phase of the EU ETS, during which the number of free allowances has been greatly reduced.

The point by Teixidó, Verde, and Nicolli (2019) that suggests that firms undervalue their free allowances raises the question of the degree to which cost passthrough happens and whether grandfathering manifests as a windfall (as the economic theory would predict). Arlinghaus's (2015) review of the EU ETS concludes that cost passthrough is substantial, though it occurs to differing extents across different sectors. Gugler, Haxhimusa, and Liebensteiner (2020) confirm findings of cost passthrough, noting an increase in electricity prices as a result of the taxes in the British power sector. On grandfathering and passthrough, Arlinghaus's (2015) review describes variability across industries, though some firms receiving grandfathered permits pass through 100 percent of the costs. Notably, such behavior leads Arlinghaus (2015) to conclude that the impact of the EU ETS on competitiveness among regulated firms is negligible, with several studies showing that regulated firms experienced an increase in revenues after the implementation of the EU ETS. Dechezleprêtre, Nachtigall, and Venmans (2018) confirm this conclusion, finding no statistically significant negative impacts on the competitiveness of regulated firms—in fact revenues and fixed assets increased—despite finding a 10 percent reduction in emissions between 2005–2012. As such, they likewise conclude that concerns about competitiveness have been vastly overblown (Dechezleprêtre, Nachtigall, and Venmans 2018). The same pattern emerges for employment (Arlinghaus 2015).

²⁹ Seven of which use econometric methods. The remaining fifteen use qualitative or descriptive analyses.

Notably, studies on competitiveness and employment caveat their findings, pointing out that they are likely limited to cases of relatively low prices and high levels of grandfathering. Under more stringent caps and greater auctioning, these results might not persist (Arlinghaus 2015; Dechezleprêtre, Nachtigall, and Venmans 2018).

Questions around the impact of carbon pricing on technological transformation also point to the question of whether it is carbon pricing or other policies or processes that have done the most work in achieving emissions reductions. In this regard, the available evidence is limited and again appears mixed. Green (2021) suggests that the emerging evidence points to most emissions reductions being the result of other regulatory instruments. On the other hand, Bayer and Aklin (2019) find that the EU ETS drove emissions reductions more quickly than did other measures. Gugler, Haxhimusa, and Liebensteiner (2020) confirm this conclusion, finding that British energy taxes were responsible for most of the emissions declines in the power sector (60 percent), doing more to reduce emissions than a number of other policies, including: a renewable energy subsidy; air quality requirements for power plants; and decreasing overall energy demand.

ANNEX C. CARBON MARKETS: INTERNATIONAL TRADE, ARTICLE 6, INTERNATIONALLY TRANSFERRED MITIGATION OUTCOMES (ITMOS), AND AFFORESTATION

This report provides a relatively comprehensive account of the major dimensions and concerns regarding efforts to price CO₂. That said, there are several ancillary issues related to carbon pricing that, while not inherent to the issue, come up in policy discussions on the matter. Such issues primarily revolve around the interaction between carbon prices and offsets. This annex of the report reflects on such issues, highlighting the appeal and concerns related to offsetting.

As was mentioned above in the section arguing against carbon pricing, both cap-and-trade approaches and taxes serve to effectively abstract CO₂ into a monetary value, thereby commodifying it. In doing so, they render the CO₂ fungible. This fungibility increases the scope for emissions from the burning of fossil fuels to be swapped for the emissions (and more importantly the potential emissions) from other sources (though this swapping need not be allowed by the policy). Scope for creating carbon credits and offsets (Bumpus and Liverman 2008) is in turn created. Crediting refers to the idea that instead of surrendering permits upon emitting CO₂, if one takes actions to sequester CO₂ or to reduce emissions that might have otherwise occurred, one could be afforded a credit. This credit can later be surrendered in lieu of a permit when emitting CO₂. Offsets follow the same logic: rather than surrendering a permit and reducing the emissions cap, one can emit CO₂ and then offset those emissions by sequestering emissions elsewhere (Boyce 2018). While carbon pricing is often associated with crediting and offsets, it should be noted that this association need not be the case. One could put in place a carbon pricing mechanism and not allow for any crediting or offsetting, requiring permits to be surrendered or taxes to be paid whenever emissions occur, without scope for accruing credits for actions taken to sequester carbon. That said, by putting in place a mechanism to render emissions fungible, the barriers to realizing offsets and credits are substantially reduced. Further, outside of carbon pricing legislation, there may be agreements in place that can allow for the international trade in carbon. For example, the Kyoto Protocol, via the Clean Development Mechanism (CDM),

made allowances for the international trade in carbon credits available to signatory parties that had in place an emission reduction or emission-limitation commitment. In this context, if a country has a carbon price in place that is limiting emissions, a clear means for incorporating credits into that system is created.

The attraction behind crediting and offsets is twofold. First, while some emissions can be reduced at relatively low costs, others will be extremely expensive to address. Where abatement costs are low, technology switching makes sense. However, where emissions are extremely expensive to reduce, rather than seeing the price of goods increase enormously, it would be cheaper (and more politically palatable) to simply emit that CO₂ and then sequester the same amount of carbon elsewhere. Ideally this process would allow the world to meet emissions targets, while also ensuring that prices don't get so high as to undermine human well-being (Reay 2020; World Bank 2020).

The second motivation for crediting and offsets extends this logic, pointing out that emissions reductions in less-industrialized countries tend to be less expensive than they are in industrialized ones. This difference is because less-industrialized contexts tend to use less-efficient production processes, and have cheaper labor, cheaper land, and more intact forest (Bumpus and Liverman 2008), with forests affording one of the cheapest options for carbon sequestration (World Bank 2020). Since improved efficiencies, land-based carbon sequestration efforts, and afforestation/avoided deforestation are all major means for reducing emissions/sequestering carbon, the ability to gain credits or to offset emissions via investments in these outcomes in the global south is proposed to offer a win-win solution. The same amount of CO₂ is abated, and since CO₂ warms the atmosphere equally regardless of where it was produced, the reduced warming of these investments is achieved equally. At the same time, the cost of reducing emissions is decreased for everyone (Bumpus and Liverman 2008). In the case of efficiency improvements, there is a transfer of technology between the global south and global north. In the case of afforestation/avoided deforestation, ecosystem services are restored/left intact, driving a variety co-benefits (Arhin 2014; Bumpus and Liverman 2008).

Despite this neat articulation, there are real challenges with realizing these potential benefits. Challenges include i) establishing baselines and demonstrating additionality, ii) ensuring any sequestration activities are permanent, and iii) ensuring that the sudden valorization of previously marginal territories does not result in enclosure and expulsion. Challenges around i) establishing baselines and demonstrating additionality pertain to the fact that the benefits of carbon crediting are only realized if the sequestration or efficiency gains that occur would not have been realized without the intervention. Otherwise, there is scope for emissions to increase more than would have been the case without crediting. Thus, one needs to ensure that the emissions

reductions are additional, which in turn requires establishing current emissions baselines. Both processes are fraught, as they rely on counterfactuals that are impossible to demonstrate and on resolving tangled and complex causal relationships. Further, determining the exact quantities of emissions reduction/sequestration can be challenging. For example, some technologies, such as cookstoves, suffer from highly variable uptake, making any estimate of their impact on abated emissions extremely difficult. Likewise, forest sequestration depends on a variety of environmental factors, which are liable to change over time (Bumpus and Liverman 2008).

Challenges around ii) permanence result from the fact that increased CO₂ emissions lead to increased levels of atmospheric CO₂ concentrations for periods on the order of 100–500 years. For sequestration to be effective, it therefore needs to be effectively permanent (Reay 2020; Dehm 2016; Bumpus and Liverman 2008). For example, institutions ensuring reforestation or avoiding deforestation need to be able to guarantee these new carbon reservoirs will remain in place and not be cut down or burned. Guaranteeing institutions and enforcement on this timescale is almost impossible.

Finally, major concerns exist around the scope for significant human rights abuses and the impoverishment of people living in forest areas. These populations, whose territories have long been marginal and whose needs have long been neglected, now find their land valued as a carbon sink. The sudden monetary valorization of this land stands to iii) drive enclosure, with groups whose livelihood is tied to the forest potentially being excluded from the forests that sustain them on the grounds that they represent a threat to the permanence of carbon sequestration in forests (Arhin 2014; Ituarte-Lima and McDermott 2017; Dehm 2016).

In addition to these broad concerns, authors have also pointed out how crediting, especially efforts to take advantage of cheaper carbon abatement/sequestration in the global south, stands to drive unjust “accumulation via decarbonization”—as the sale of credits and offsets creates opportunities for profit among trading firms (Bumpus and Liverman 2008; Dehm 2016). This is a more pointed articulation of the dangers of commodifying carbon that was described in the main report. However, when carbon comes to be traded not only for money but also for other ecosystems and assets, schemes begin to echo uncomfortable neocolonial attitudes in which emissions, accumulation, and improved quality of life continue in the global north, while the cheap resources of the global south are exploited as a location in which to effectively dump pollution (Bumpus and Liverman 2008; Dehm 2016). Of further note here is the degree to which crediting and offsetting allows for the ongoing investment in CO₂-emitting technologies that could drive much longer-term carbon lock-in and make goals around limiting temperature rise impossible (Dehm 2016).

A final criticism encountered during this review is that poorly managed efforts at afforestation can compromise effective fire management in temperate forests, with counterproductive impacts for emissions. To this end, Hurteau, Koch, and Hungate (2008) model how valuing sequestration creates an incentive to allow forest stands to thicken on the basis that doing so affords increased levels of carbon sequestration. Thickening drives an increased risk of greater catastrophic fire that, when realized, drives larger overall emissions due to uncontrolled burning than would have occurred if stands had been thinned. Such dynamics are of particular concern in temperate forests with a historic propensity for frequent, low-intensity fires (Hurteau, Koch, and Hungate 2008).

The challenges just described are well known, and two institutions have been set up to try to govern most of them. The first, the Clean Development Mechanism (CDM) was set up under the Kyoto Protocol, to govern crediting for investments that abated emissions in other countries. These investments included ones in clean power and other efficiency improvements that reduce emissions. To this end, the CDM was concerned with procedures around baseline assessments and determinations of additionality, as well as the creation of monitoring and technical reporting standards aimed at estimating how many emissions were effectively sequestered. Notably, at the outset, the CDM debated whether successful efforts to reduce deforestation and forest degradation would be included in the mechanism, due to difficulties with ensuring additionality. In the end, such issues were excluded from the mechanism.

Ongoing and substantial concerns over deforestation, regarding both the impact on forest populations and GHG emissions, resulted in the creation of REDD (reducing emissions from deforestation and forest degradation, later REDD+³⁰). REDD was established under the UNFCCC, with the aim of creating incentives for the effective management of forests as both reservoirs of human well-being and carbon. Within REDD+, the main approach to addressing concerns around human rights abuses, enclosure, and exclusion has been to focus on the use of safeguards, requiring the inclusion of principles such as free, prior and informed consent (FPIC) and the establishment of tenure rights (Dehm 2016). In all cases, concerns around neocolonialism have been responded to with a requirement for country ownership over which projects get selected for implementation (Bumpus and Liverman 2008).

In addition to REDD+ and the CDM, there are a host of voluntary crediting mechanisms, in which actors seeking to voluntarily offset their emissions can purchase certified credits. Such systems operate on both international and sub-national levels (World Bank 2020). As with any voluntary mechanism,

³⁰ REDD+ is “reducing deforestation and forest degradation and the role of conservation, sustainable management of forests, and enhancement of the forest carbon stocks in developing countries.”

effectiveness varies. Nonetheless, such schemes are thought to be of growing importance (World Bank 2020).

All of the above efforts are compromised. The challenges with baselines and additionality remain as stated above. Issues of country ownership raise questions around who exactly determines the national interest, especially in contexts where democratic institutions are weak or where authoritarian governments derive their legitimacy primarily from the threat of force. Even in established democracies, however, challenges around NIMBYism can confound the simple idea that neocolonial power relations can be avoided on the basis of countries being able to ask for/refuse certain investments. In terms of human rights abuses, safeguards are an important tool—formalized most clearly at the Cancun Conference of the Parties (COP) in 2010—but they by no means resolve these challenges, as affected populations are exposed not only to the risk associated with the projects, but also to the risk that oversight and standards will be implemented insufficiently rigorously (Ituarte-Lima and McDermott 2017) or be ignored completely (Morrissey 2006).

Overall, experience with crediting and offsetting mechanisms remain extremely problematic. Most concerning is the extent to which the literature is replete with examples of projects driving significant negative effects among affected populations (Dehm 2016). For example, Arhin (2014) points to the array of cases describing displacement, forced eviction, and military brutalization of local communities, resulting in the loss of non-consumptive use values such as places of worship, loss of rights to use resources, and foreclosure of rights to future use. The negative impacts of such outcomes are thought to be multiple, including: deprivation, impoverishment, landlessness, homelessness, economic marginalization, and joblessness (Arhin 2014).

As a result, there is an ongoing tension between the view of crediting as an exploitative and unworkable system and the stance that it is of fundamental importance to achieving climate goals, if only it can be configured correctly (Dehm 2016). On this front, a number of authors highlight the extent to which indigenous groups in particular, as well as their partners in the global north, have been explicitly opposed to crediting mechanisms on the grounds that the distribution of risks and benefits is vastly unequal (Bumpus and Liverman 2008). Despite this opposition, the thrust of global negotiations has been towards more international trade in carbon credits, with the focus on how to get carbon trading right rather than asking whether it should be done at all. In this context, critics have accused proponents of crediting schemes of simply trying to legitimize the damaging process of incorporating forest people in particular into the green economy (Dehm 2016). Of further note is the fact that while issues of integrity pertaining to permanence and additionality impact the global north via their potential impact on emissions and temperature rise, issues around the integrity and implementation of safeguards only affect those people who need

safeguarding. It is notable then that questions of additionality and permanence are subject to detailed UNFCCC rules regarding accounting and monitoring. Safeguarding on the other hand is intended to be country driven, with little reporting other than countries stating that they are implementing safeguards (Ituarte-Lima and McDermott 2017; Dehm 2016).³¹

The latest iteration of these processes is Article 6 of the Paris Climate Agreement. Article 6 forms something of a replacement to the CDM, which expired on December 31, 2020.³² The exact terms of Article 6 are still being agreed, but the overall aim of the initiative is to increase the fungibility of mitigation actions and open them up for trading across countries so as to drive mitigation towards the lowest-cost options globally, and thereby reduce the overall cost of addressing climate change (Schneider and La Hoz Theuer 2019; La Hoz Theuer, Schneider, and Broekhoff 2019). This is to be done via the creation of rules to allow for the international transfer of mitigation outcomes (giving rise to the phrase “internationally transferred mitigation outcomes” (ITMOs)). Points of disagreement over Article 6 are multiple, including whether it will cover avoided deforestation/degradation, whether credits accrued under the Kyoto Protocol will be respected, and how the proceeds from levies on transactions will be used (World Bank 2020). While Article 6 offers a chance to implement learnings from the CDM, fraught issues around baselines, accounting, equivalence, permanence, and country and local ownership persist—and continue to drive disagreement over the exact terms of the Article. Again, the two fundamental concerns pertain to the risk of human rights abuses and the potential for loopholes that, when exploited, would result in higher levels of emissions than would have occurred had Article 6 not been enacted (Schneider and La Hoz Theuer 2019).

The above set of issues constitute very real concerns for Oxfam: does crediting effectively reduce the cost of mitigation and advance action on climate change, or do the inevitable loopholes and monitoring challenges mean that emissions will be higher than they would have been without the mechanisms in place? Further, will carbon markets result in technology transfer and the protection of ecosystem services or will they advance neocolonialism, driving human rights abuses and undermining the well-being of the most marginal populations on the planet, effectively compounding their vulnerability to climate change? Carbon pricing interfaces with these issues in that it increases the fungibility of emissions reductions in countries implementing a price, thereby advancing opportunities for

³¹ Note these issues of integrity should not be confused with highly prescriptive safeguards. There is a preference for a flexible approach that allows countries to transform safeguarding principles into actual relevant national legislation (Ituarte and McDermott 2017).

³² Note the Executive Board of the CDM agreed to temporary measures to extend the CDM through to the Glasgow Conference of the Parties (COP) in 2021, after the COVID-19 crisis led to the 2020 COP being cancelled, meaning there was no way for determining how CDM processes would be continued or cancelled.

crediting and offsetting in other countries. At the same time, efforts (such as Article 6) are moving forward to increase this fungibility regardless of whether a country has a carbon pricing initiative in place. Therefore, while the issues discussed in this final section of the report are of extreme importance, it's not clear they should be the primary concern when contemplating the politics of adopting a carbon price.

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