The Social Cost of Carbon, Humility, and Overlapping Consensus on Climate Policy

Mark Budolfson

Introduction and Overview

Social cost of carbon (SCC) estimates are the primary guide to carbon pricing policy proposals and are also commonly used along with other models to estimate the magnitude of greenhouse gas (GHG) emissions reductions that it would be best for nations and the world to make in the coming decades in order to mitigate climate change.

At first glance, it may seem that an SCC-based approach to climate policy (e.g., an economy-wide carbon tax calibrated to the SCC) presupposes a set of very controversial assumptions, especially about what detailed knowledge regulators have about the impacts of climate change and what the proper role of government and policy is in responding to those impacts. At worst, it may initially appear that an SCC-based approach assumes an omniscient and omnibenevolent social planner who

M. Budolfson (✉)
Rutgers University, New Brunswick, NJ, USA
e-mail: markbudolfson@gmail.com

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can be relied upon to perfectly implement a perfectly known regulatory "solution" to the problem of climate change (and solve all other inefficiency and equity problems in the background)—all of which would be an implausible set of assumptions if those were truly a presupposition of the SCC-based approach.

However, as I explain in what follows, the SCC-based approach need not have these problematic presuppositions, and in fact SCC models can provide the best guide to climate policy when implemented in a way that incorporates a healthy dose of humility. In the next section I begin by briefly explaining the SCC-based approach, and then in the section "A Modest Carbon Tax Derived from SCC Estimates as an Alternative to a Pigouvian Tax," I explain why it is compatible with humility about our knowledge of the impacts of climate change, humility about the incentives of regulators and other actors in society, and humility about the limits of government.

I then explain in the section "Overlapping Consensus, Ecumenical Climate Policy, and the SCC-Based Approach" why the SCC-based approach can be used in a way that is ecumenical between the wide range of reasonable but incompatible views about the proper goals of government and policy, ranging from mere market-efficiency aimed views, to utilitarian views, to rights-based and other deontological views, to libertarian views, to virtue ethics views, and others. Beyond this, I suggest that the SCC-based approach can help us find an overlapping consensus on a particular climate policy given the range of reasonable but incompatible normative views endorsed in diverse societies, where these views in many cases will have incompatible implications about what climate policy would be ideal. This may have important implications for what climate policy is politically justifiable given the fact of reasonable pluralism. It also may have implications for what is justifiable according to some specific views, especially views such as deontology and/or libertarianism that see the mere promotion of aggregate social welfare as an insufficient justification for the coercive policy, and require instead broad-based consent to such coercion as necessary for justification. In this way, I argue that the SCC-based approach is compatible with liberal (and classical liberal) conceptions of the proper role of government. In addition to these normative considerations, identifying an overlapping

consensus may also have practical political importance, as it may help identify a strategic coordination point for climate policy around which a successfully coalition may be built.

Finally, in the section "Additional Worries About the SCC-Based Approach," I consider a number of more specific objections to the SCC-based approach that are especially prominent in contemporary discourse and policy debates. These include several arguments that the SCC-based approach systematically recommends too much mitigation, as well as several arguments that it systematically recommends too little mitigation. I also consider an argument that it recommends the wrong mechanisms for emissions reductions. I suggest that even if we agree that all of these objections to existing SCC-based analyses have an important kernel of truth, they do not undermine arguments that the correct response to climate change still involves substantial emissions reductions to be achieved via policy, and that the best methods for deciding the magnitude of those reductions still depend essentially on the SCC-based approach. Thus, even those who agree with these important worries do not thereby have a good reason for wholesale rejection of policy guided by SCC estimates, and in fact they should still find action-guiding value in those estimates as one of the best available tools for deciding what we should do about climate change.

The Social Cost of Carbon

The Social Cost of a Pollutant: The Basic Idea

Before explaining in detail the methods used to estimate the social cost of carbon (SCC), it may be useful to begin with a simple illustration of the basic idea of the social cost of a pollutant. To illustrate the basic idea, imagine a hypothetical world like ours except that instead of fossil fuels industrial activity often relies on intoxicating fuels. Specifically, suppose that these intoxicating fuels function exactly like fossil fuels in industrial activity, but fortunately do not have greenhouse gasses as a side effect of their combustion. Unfortunately, they instead emit an intoxicating

gas that quickly spreads evenly through society. Suppose that this intoxicating gas has little effect in small concentrations but is a big problem in aggregate concentrations that result from the large sum of all emissions of the intoxicating gas across society. Suppose further that after careful observation over many decades, we can see a clear increase in accidents and a clear reduction in worker productivity, and social and natural scientists have identified this intoxicating gas as the main culprit beyond a reasonable doubt.

To make this imaginary case simple and clear (but also disanalogous to the case of climate change, which involves greater uncertainty), suppose that scientists can predict fairly precisely the magnitude of intoxication that will result from higher and lower concentrations of the pollutant. Suppose further that economists and other researchers can also make fairly precise, high-confidence estimates of the additional deaths due to accidents that should be expected as a function of higher and lower concentrations of the gas, as well as the greater and lesser loss of GDP we should expect as a function of higher and lower concentrations of the gas (given the loss of productivity due to well-understood dynamics of intoxication).

Given all of these suppositions, it is easy to see how in this hypothetical case we could make a good quantitative estimate of the harm to people now and into the future of additional emissions of the intoxicating gas. In particular, the previous paragraph supposes that scientists can reliably and precisely identify "damage functions" along at least two dimensions of harm: first, the quantity of additional deaths from accidents that would result from an additional unit of emissions, as well as, second, the quantity of lost GDP that would result from an additional unit of emissions. Following the relevant terminological conventions—and in the sense of "social cost" relevant to this paper—we can call the sum of these harms from additional emissions of the gas the social cost (i.e., the cost to society) of additional emissions of that gas.

Note how useful it can be to this society to have an estimate of the social cost of intoxicating gas emissions. Among other things, such an estimate would tell them quantitatively how bad additional emissions are in terms of their net harm to society, as well as conversely how much they would benefit from reducing emissions. This would then be useful in deciding what specific responses to the problem might be better and

worse. For example, if people in this hypothetical scenario were considering a policy to reduce emissions by 50% over a decade that was known via the social cost estimate to imply avoided GDP loss of $N billion a year as well as M lives saved, then such a policy would be better than doing nothing insofar as they could be sufficiently confident that it could be implemented successfully and cost much less than $N billion, and not be a bad idea for other reasons. Of course, correctly estimating the cost and side effects of a specific policy is a much more difficult challenge that goes beyond calculating the social cost, and this will be further discussed below. The current point is merely to illustrate that the social cost of a pollutant is an easy-to-understand fact that can be investigated using familiar methods from science and economics, that in some cases it could be useful and feasible to estimate quantitatively, and that it is a proper subset of the overall policy equation (which must also take into account cost and feasibility of policy, broadly construed, along all other dimensions, as well as other factors). With this simple illustration of the basic idea of the social cost of a pollutant in hand, I turn next to explaining the methods used to estimate the social cost of carbon.

The Social Cost of Carbon (SCC), and Estimates of the SCC

The social cost of carbon (SCC) is the net harm to everyone now and into the future of an additional unit of carbon emissions. As such, an estimate of the SCC aims to capture the cost to society of additional CO_2 emissions and, conversely, the benefit to society of reducing those emissions. By convention, the SCC is estimated for one additional ton of CO_2 emitted in a particular year, and is monetized in present-day dollars.

Methods of estimating the SCC are analogous to the hypothetical example above, where the main task is to account for the economic, health, and other non-market impacts of the pollutant now and in the future. Estimating the SCC is much more complex than the example above because there are many more dimensions along which health and living standards are impacted by carbon emissions and these impacts

are much more uncertain, especially in long-term timescales. In outline, existing methods begin by estimating the climate impacts of the emission of one additional ton of CO_2 (i.e. the impacts on temperature, sea level rise, etc.) and then estimate the economic, health, and other non-market impacts of those climate impacts for each year into the future (e.g. both positive and negative impacts, such as increased air conditioning expense, lower heating expense, loss to long-run GDP, loss from increased flooding, increased mortality and morbidity from heat stress, malaria, etc., decreased mortality and morbidity from frigid winter temperatures, etc.). They then monetize all of those disparate economic and non-market impacts for each year into the future so that a single net monetized damage can be calculated for each future year before calculating the SCC as the present value of the sum of all of those future net yearly damages (where the present value calculation discounts future damages in a principled way, e.g. taking into account interest rates, the anticipated wealth of future people, and [optionally] pure time preference).[1]

In this way, an SCC estimate aims to capture in clear quantitative terms the cost to society of additional CO_2 emissions and conversely the benefit to society of reducing those emissions. Note that each step in this analysis is more multi-dimensional and more uncertain than the simple example in the previous section. Nonetheless, many of the most important components of the SCC analysis are similarly straightforward (e.g. estimating heat-related mortality as a function of higher temperatures, estimating the impact on long-run GDP of heat-related productivity loss, estimating the net cost of heating and cooling expenses as a function of higher temperatures) and are tractable questions that can similarly be productively investigated by scientists and economists, albeit with wider bands of uncertainty.

The SCC-Based Approach to Climate Policy

Given SCC estimates, it is a further substantive question what specific climate policies should or should not be recommended given those estimates. An SCC-based approach to climate policy uses SCC estimates in

an important way as a basis for climate policy recommendations. One way of doing this is to simply derive climate policy from SCC estimates using a particular "formula" for policy.

For example, the most common and simple way of deriving climate policy from SCC estimates is also the leading example of market-based environmental policy in many economics and policy textbooks: namely a Pigouvian carbon tax, in which a carbon tax is imposed each year into the future equal to the SCC estimate along the optimal emissions reduction trajectory (where the marginal abatement cost equals the marginal social cost of emissions)—and where this serves as the only climate policy.[2] Practically speaking, the goal of a Pigouvian tax is to force polluters to pay the true cost to society of their emissions while creating incentives across society that lead to a new outcome in which emissions of that pollutant are reduced to the optimal level. This is the optimal level in the sense that if emissions were reduced any further via a higher price there would be incremental economic costs to society that would outweigh the incremental benefits of the avoided pollution, and if those emissions were allowed to be any higher via a lower price, there would be incremental costs to society in terms of additional pollution that would outweigh the incremental economic benefits of allowing the additional pollution. Investment in the development of new clean technologies is thereby also incentivized in a way that reflects the true costs and benefits to society of those investments—and additional policies are inadvisable because they would only create unnecessary further distortions. In economic theory, this is a first-best regulatory response to the negative externality of carbon pollution, which has the virtue of reducing total emissions to an optimal level in the way that has the lowest possible cost to the economy (given standard textbook assumptions).[3]

Note that while the Pigouvian carbon tax is an instance of the SCC-based approach, it is only one among many different possible ways of deriving climate policy from an SCC estimate. Specifically, the Pigouvian tax approach adds the following controversial assumptions that go beyond the basic commitments of the SCC-based approach: namely that (i) the one and only instrument of climate policy should be emissions pricing, (ii) a tax is the best method for pricing (as opposed to e.g. cap-and-trade), (iii) the tax should be set at a level that would maximize

economic benefits according to central estimates of the SCC, and (iv) side effects, background inefficiencies, and inequities from other sources can be ignored or should be dealt with by other policies.

Each of these assumptions is controversial and point the way toward possible alternatives to a Pigouvian tax. In the next section, I'll highlight one particular alternative that should be more widely discussed, especially because it illustrates the ability of the SCC-based approach to mitigate important worries about a Pigouvian tax, especially worries about assumptions (iii) and (iv) above.

A Modest Carbon Tax Derived from SCC Estimates as an Alternative to a Pigouvian Tax

If one believes that climate change is a deep problem for society and understands the concept of the social cost of carbon (SCC), then one is committed to thinking that the SCC is not zero—in other words, that there is indeed some net harm done by additional carbon emissions that could at least in principle be quantified. If one also believes that science and economics can help us estimate the SCC but that large uncertainties and deep methodological challenges are involved in such estimates, then one basically agrees with mainstream climate economics, which reports the social cost of carbon with the disclosure of many methodological challenges and increasingly focuses on stochastic methods to more precisely estimate the contours of our wide band of uncertainty about the true value of the SCC given the evidence.[4]

With this uncertainty in mind expressed as confidence intervals for the true value of the SCC, we can consider a simple SCC-based alternative to a Pigouvian tax: Instead of a carbon tax set equal to the central estimate of the SCC (which the Pigouvian tax does as a consequence of its assumption (iii) above that benefits are to be maximized in expectation), a carbon tax could instead be set to a lower level (a fraction of the central estimate), corresponding to a higher degree of confidence that the true value of the SCC was at that lower level or higher. This might be particularly attractive to those who agree that climate change is harmful on net, and thus the SCC is positive, and agree that collective action is

necessary to mitigate this harm, but who are also concerned about the limits of our knowledge and the limits of government to estimate the best policy response and have the right incentives to do what is best.

To give a name to this alternative approach and to give it concreteness for our subsequent discussion, let's call it the Modest Carbon Tax, which (merely for ease of exposition) we can stipulate more precisely to be a carbon tax set equal to the point at which SCC estimates are (let us stipulate) 95% confident that the true value of the SCC is at that level or higher.[5] The arbitrary choice of 95% illustrates how this alternative approach can deliver a precise concrete formula for deriving policy recommendations from SCC estimates. Of course, this precisely stipulated value is just one member of a family of recommendations that could result from the choice of different confidence levels. To see the more general family, note that any choice of confidence threshold above 50% yields an SCC-based alternative to the Pigouvian approach.

The more general conceptual point that uncertainty analyses of social cost can yield more modest policy recommendations than the central estimate simply by choosing a higher confidence threshold is illustrated by Fig. 1.

One thing to note about the Modest Carbon Tax (and other members of the more general modest policy family that it represents) is that it

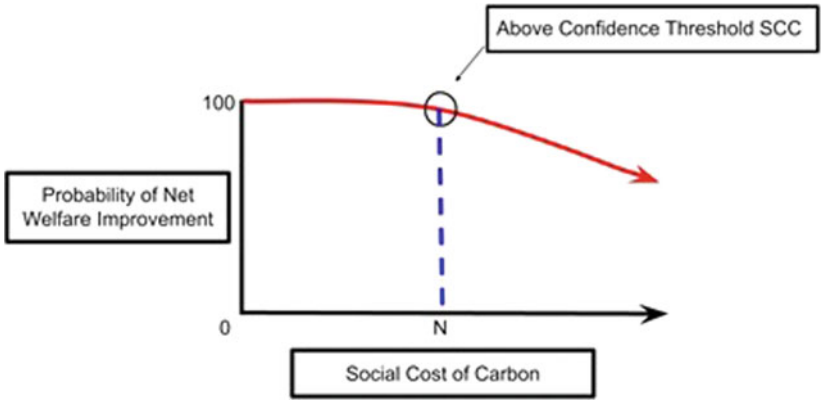

Fig. 1 Probability of net welfare improvement as a function of policy implementing specific social cost of carbon estimates

is indeed an SCC-based approach, based on the very same SCC estimates as the Pigouvian approach and equal to the Pigouvian approach in simplicity, but yet it provides a clear and substantive alternative to the Pigouvian approach. It rejects assumption (iii) of the Pigouvian approach that policy should aim to maximize welfare, and it presumably faces less worry in connection with (iv), as a lower carbon tax would be a less powerful intervention along the same vector, and thus would have less troublesome implications than a higher carbon tax regarding negative side effects, interactions with background distortions and inequities, etc.

There are a number of important upshots of this simple point. Perhaps the most important for our purposes is that the Modest Carbon Tax shows how the SCC-based approach can incorporate a number of noteworthy features not shared by the Pigouvian approach, including greater humility. In particular, the Modest Carbon Tax illustrates how an SCC-based approach can be compatible with greater humility about our knowledge of the impacts of climate change, even beyond the methods of uncertainty increasingly central to the SCC estimates themselves. The Modest Carbon Tax also can incorporate greater humility about the limits of governmental regulation—in particular, it is implicitly sensitive to the obvious fact that actual governments are very far from omniscient and omnibenevolent social planners who can be relied upon to perfectly implement perfectly known regulatory "solutions."[6] In particular, the Modest Carbon Tax can implicitly incorporate humility about the limits of governmental knowledge, incentives, and regulatory success, including what levels of mitigation ambition are increasingly likely to trigger large negative unintended consequences, which could at the extreme outweigh the direct good done by a carbon tax. One obvious way the Modest Carbon Tax implicitly incorporates humility about regulation is that it is more likely to be an improvement over the status quo than a Pigouvian tax based on the higher degree of confidence that a lower carbon tax will yield an improvement versus a higher carbon tax equal to the central estimate of the SCC recommended by the Pigouvian approach. Along another dimension, by recommending a simple predictable tax rather than, say, a cap-and-trade system or other mechanisms for putting an implicit or explicit price on carbon, it can avoid some worries about capture and unintended negative consequences that

are greater in connection with those other approaches.[7] And finally, by rejecting the welfare maximizing assumption (iii) of the Pigouvian approach, the Modest Carbon Tax becomes consistent with the wide range of reasonable alternative normative views about how to respond to societal challenges like climate change and other social problems. I discuss this last virtue in greater detail in the next section.

Overlapping Consensus, Ecumenical Climate Policy, and the SCC-Based Approach

Ecumenical Climate Policy: How the SCC-Based Approach is Neutral Between Different Reasonable Normative Frameworks

In this subsection I explain why the SCC-based approach can be used in a way that is ecumenical between the wide range of reasonable but incompatible views about the proper goals of government and policy, ranging from mere market-efficiency aimed views, to utilitarian views, to rights-based and other deontological views, to libertarian views, to virtue ethics views, and to other views. Beyond this, in the next subsection, I suggest that the SCC-based approach can help us find an overlapping consensus on a particular climate policy given the range of reasonable but incompatible normative views endorsed in society.

As explained in the previous sections, the most common application of the SCC-based approach is a Pigouvian tax, which aims to minimize the costs of correcting a negative externality, typically with the ultimate policy goal of maximizing benefits via an "optimal" policy (typically assuming other optimal policies are implemented for other market failures). This approach is aimed at market-efficiency and perhaps ultimately a form of utilitarianism/traditional consequentialism.

However, as noted in the previous section, there are other straightforward SCC-based approaches such as the Modest Carbon Tax that do not aim to optimize anything. More generally, the SCC-based approach is compatible with a wide range of normative frameworks, including those

that reject traditional consequentialism. Perhaps the easiest way to see this is to consider the alternative normative framework of deontology, which is the classic contrast to utilitarianism/traditional consequentialism. Deontology emphasizes equity, justice, and the avoidance of doing harm as canonical constraints on what actions or policies may be chosen. So, whereas utilitarianism recommends the climate policy that is estimated to have the best wellbeing consequences, deontology might reject that policy because it is unjust, because it lacks sufficient distributional equity, or because it does not do enough to mitigate deaths due to unnecessary emissions by the rich—and instead prefer a different policy that best respects those constraints.

At first glance, it might appear that deontology is incompatible with an SCC-based approach, at least before considering the details of SCC estimates explained above. However, building on the explanation from section "The Social Cost of Carbon (SCC), and Estimates of the SCC" above of the methodology of SCC estimates, we are now in a position to note that in fact SCC estimates aim to quantify deaths as a function of climate change, as well as the locational distribution of both deaths and economic losses.[8] Indeed, SCC estimates are the only existing scientific estimates of death from climate change as a function of different climate policy choices, as well as estimates of the locational distribution of both deaths and economic losses.[9] Thus, from a deontological perspective, these estimates are the natural starting point for evaluating which actions or polices will best avoid causing unnecessary deaths[10] and which policies do best on other criteria of justice and equity.[11]

In fact, these estimates are already used in some applications to evaluate distributional equity (see previous citations) and in the process can be used to educate normative theorists about the difficult and necessary tradeoffs that must be made in climate policy, which normative theorists often ignore. For example, the accounting used to make SCC estimates can make visible the fact that there are deaths "on both sides of the ledger" that much be considered in climate policy, as increased emissions reductions will itself cause increased death via foregone development in poor nations, via higher food prices, etc. So, if one's goal is to evaluate climate policy from a deontological view that aims to prevent causing deaths, then SCC estimates and, in particular, the underlying integrated

assessment models and components are the best tool available.[12] (Here I am assuming for ease of exposition that non-consequentialist views have the objective to increase equity-weighted net benefits for society subject to side constraints of the sort relevant to large-scale global policy such as "minimize unnecessary deaths."[13] More nuanced deontological objectives might be preferred by some theorists, but the same point applies that SCC estimates are the best guide available for more nuanced deontological policy recommendation as well).[14]

The discussion so far in this section of how the SCC-based approach is compatible with deontology also generalizes to other reasonable normative theories, given that the core concerns of deontology are one or more of the core concerns of other reasonable normative frameworks for policy analysis (i.e., concerns for justice, equity, and avoiding unnecessary harm). Other important normative frameworks such as virtue ethics, feminist ethics, political liberalism, and global ethics emphasize first and foremost an external critique of the methods of most consequentialist and deontological ethics, and perhaps also emphasize structural features of society as the most urgent locus of normative concern. Their policy recommendations, however, are similarly based on exactly the features that SCC estimates provide the best information about: deaths, economic losses, their socio-economic distribution of deaths and losses, and how structural changes such as carbon pricing and/or climate burden sharing can change these impacts. Note that the SCC-based approach can be used to evaluate optimal policy under the range of leading approaches to distributive justice, including Rawlsian leximin, egalitarianism, and prioritarianism,[15] where these evaluations can estimate the distribution of wellbeing for rich vs. poor in a robust sense that includes a concern for the greater wellbeing impact of dollars lost to the poor than the rich,[16] and can estimate the distribution of non-market changes in death from climate change and air pollution.[17] Thus, the implications of these other normative theories for climate policy are also naturally illuminated by the SCC-based approach and its underlying modeling estimates. In addition, as noted before, the SCC-based approach has the great virtue of further educating these theorists about the difficult and necessary tradeoffs that must be made in climate policy.

Beyond the comprehensive ethical theories discussed so far (which roughly cover the range of reasonable comprehensive theories), the SCC-based approach in conjunction with carbon pricing also has the virtue of respecting individual liberty and the political principles of liberalism. In very brief terms, this is because, first, carbon pricing corrects a market failure that if uncorrected allows freely chosen activities to harm others and make outcomes suboptimal, and, second, because it corrects this market failure in the way that best preserves free choice by simply raising the cost of harmful actions to a level that properly reflects those harms.[18] This is merely an outline of what would need to be a more detailed argument that is outside the focus of this short paper—for more, see the references attached to the preceding endnote, and, for important arguments against this idea, see those attached to this endnote.[19]

Beyond these ethical theories and principles, the SCC-based approach is also ecumenical between the reasonable range of specific "policymaking principles" that might be judged applicable to climate policymaking even in the absence of commitment to any comprehensive normative theory. These principles might be the result of an overlapping consensus or incompletely theorized agreement on how to make policy in the explicit absence of agreement on comprehensive normative theory. For example, consider principles of the form "regulation R should be favored when the aggregate benefits would be X times the aggregate costs and also satisfy distributive justice principle Y." This schema itself describes a wide family of principles resulting from different choices of X and Y, and, for similar reasons noted above, the SCC-based approach and its underlying integrated assessment models provide the best available basis for evaluating the recommendations of these principles for climate policy.

Overlapping Consensus on Climate Policy: How the SCC-Based Approach Can Help Identify a Policy That Is Justifiable to All

Different ethical theories that disagree about how to rank outcomes might nonetheless agree that some policies would be an improvement over the status quo. For example—and continuing the discussion from

the end of the previous subsection—incompatible theories might agree for some choice of X, Y, and risk profile that an outcome of new regulation should be preferred over the status quo when aggregate benefits are at least X times greater than costs, the distributive implications at least satisfy minimal equity principle Y, and all of this holds with a sufficient certainty profile. Indeed, the sort of formal work on equity and distributive justice noted in the previous subsection allows for mathematically precise derivations of instances of agreement between specific comprehensive ethical theories.[20] Within the space of agreement, there will often be further agreement about how to rank the outcomes that are agreed to be better than the status quo relative to each other, which implies a frontier of agreement on policy choice between the incompatible theories.

With these conceptual inputs in hand from formal ethics, the SCC-based approach and its underlying estimates are the natural way of adding the climate policy-relevant information that is needed to then calculate the magnitude of mitigation that the different normative theories agree on. If one adds the further assumptions that a carbon tax is the instrument of choice, then the corresponding carbon tax is also thereby calculated to achieve this goal. Notice that the resulting policy recommendation will have the same general structure as the Modest Carbon Tax described above (including the property of being a carbon tax that is some fraction of the Pigouvian tax estimate), except that in this case the tax (or alternative instrument) will be calibrated to reflect the agreement on climate policy between different comprehensive ethical theories in society. In light of this, we might call it the Overlapping Consensus Carbon Tax to differentiate it from the Modest Carbon Tax above (which was simply stipulated to have a particular degree of confidence), while noting that the former will have many of the virtues of the latter—especially for those who are largely on board with the discussion so far but remain skeptical of the assumptions and aspirations of the Pigouvian tax or who at least prefer an approach that prioritizes broad-based political agreement over "Government House Utilitarianism."

The Overlapping Consensus Carbon Tax has some practical advantages given that it is agreeable as an improvement over the status quo to a wider range of political perspectives than, for example, the Pigouvian

tax. Thus, identifying the Overlapping Consensus Carbon Tax may have practical political importance, as it may help identify a strategic coordination point for climate policy around which a successful coalition may be built. As one related analogy, the Economists' Statement advocating a carbon tax together with equal per capita refund of the revenues may be seen as an attempt to promote a sufficiently broad-based climate policy to find broad-based support.[21] The fact that such a policy could find a broad consensus might be one reason it has quickly emerged as a focal point of agreement among this diverse group of experts. Empirically, one might see structurally similar political forces (often not normatively justifiable) as generating the actual agreements that explain the less-than-Pigouvian pricing for externalities that we observe in the real world even when externality pricing is the chosen instrument, as in some of the post-1990 Clean Air Act Amendments. The need for consensus provides an explanation and rationale for the more modest-than-Pigouvian pricing approaches that are the norm in real-world market-based environmental policy.

In addition to practical advantages, there are arguably also normative advantages to such an approach; many political theorists argue that political justification requires that structural features of society that are coercively imposed by the government (such as a carbon tax) and have important benefits and burdens for individuals must be supported by an "overlapping consensus" (in the Rawlsian sense) on principles that justify them,[22] or they themselves must be directly supported by an "incompletely theorized agreement" that directly supports those specific policies or principles over alternatives.[23] Thus, an approach like the Overlapping Consensus Carbon Tax might help with difficult normative questions regarding what climate policy is politically justifiable given reasonable pluralism about (principles relevant to) climate policy. It also may have implications for what is justifiable according to some specific comprehensive normative views, especially views such as deontology and/or libertarianism that see the mere promotion of aggregate social welfare as an insufficient justification for coercive policy, and require instead broad-based consent to such coercion as necessary for justification.

Summary of Distinctions Relevant to Evaluating the SCC-Based Approach and Policy Recommendations

The previous sections have argued that the SCC-based approach has more flexibility, can avoid more objections than it may initially appear, and may have additional virtues depending on exactly how one moves from SCC estimates to further conclusions about policy recommendations. In light of the preceding, and taking a step back, we are now in a better position to summarize some of the key distinctions relevant to evaluating the SCC-based approach, as well as to evaluate particular conclusions about policy recommendations based on SCC estimates. I summarize these as a series of questions that yield different evaluations depending on how they are answered:

- Is climate change harmful on balance? I.e., is the true value of the SCC positive?
  - Those who take climate change seriously are committed to answering "yes," in which case the answer to this question gives no reason for skepticism about the SCC-based approach. (Furthermore, even if it were true, contrary to general academic consensus, that the global net costs of carbon were negative (e.g. if the net benefits from warming were sufficiently large to exceed the large costs), the distribution of costs and benefits would still matter and be highly unequal, and thus GHG emitters would still be imposing net costs on many others (including imposing almost all climate costs on third parties); this would generate equity-based reason (including from the perspective of liberalism or even principled libertarianism) for carbon pricing to help address this disparity).[24]
- Are SCC models the best tool for making estimates of the SCC, including the range of uncertainty over the true value of the SCC?
  - Mainstream climate economics and governmental cost–benefit studies argue that the answer is "yes," but some experts have disagreed even while taking climate change seriously (see Pindyk,

for example). I set aside this issue in this paper, except to note that even critics of SCC models such as Pindyk often believe that the SCC should still play a primary role in climate policy, albeit with estimates using different methods, such as expert elicitation.[25]

- Should the magnitude of our emissions reduction ambition simply reflect the central estimate of the SCC, as in the Pigouvian tax approach? Or if not, what are the further factors that are relevant to deciding what policy implementation we should favor and disfavor? For example, do we need to further incorporate worries about the costs of policy, feasibility, political economy, justification, unforeseen negative side effects of governmental controls, ethical reasons that climate policy should explicitly reflect weights for equity and justice, etc.? Should our ambition be calibrated to an overlapping consensus between incompatible normative theories that represent the range of reasonable views in society?
  - Many argue that there are further relevant factors of equity, political justifiability, and the like not accounted for by the Pigouvian tax approach, even assuming correct estimates of the SCC.[26] The Modest Carbon Tax (and the discussion in the last two sections) illustrates how endorsing the importance of these further factors is nonetheless consistent with endorsing the SCC-based approach.
- Should carbon pricing be one main aspect of our overall response to climate change?
  - Most economists and the vast majority of climate policy experts argue that the answer is "yes" (even while some also argue that other policies or regulations are needed as well[27]), which provides natural motivation for the SCC-based approach to the carbon pricing component of an overall response to climate change.[28] This is for many reasons, including greater efficiency, creating the best incentives for green innovation,[29] and less legal and political economy risks.[30] In addition, even if one answered "no," SCC estimates might still be useful in deciding the magnitude of emission reductions to aim for via other policy instruments. Beyond noting these arguments, I set aside this issue in this paper.

- Should a carbon tax be the main policy instrument for carbon pricing or something else?
  - A majority of economists and climate policy experts argue that the answer is "yes" and thus that a carbon tax is preferable to other forms of carbon pricing, such as a global cap-and-trade system. This is largely due to transparency, reduced worries about corruption, and the advantages of a more predictable price signal than with alternative forms of carbon pricing.[31] Thus, a carbon tax has many advantages from the perspective of those who stress modesty in climate policy proposals. Beyond noting these advantages, I set aside this issue in this paper.

In sum, endorsing the SCC-based approach as the best way forward for climate policy is consistent with endorsing many worries about mainstream climate policy recommendations and is consistent with skepticism about many possible applications of an SCC-based approach, such as the Pigouvian approach.

Additional Worries About the SCC-Based Approach

There are many important residual worries about the SCC-based approach that might be developed in more detail. In this section, I'll highlight a few important worries that are especially prominent in contemporary discourse and policy debates, and I'll also provide a quick outline of some possible replies, without pretending to settle the issues raised. Most of these worries fall under the partially overlapping headings of political economy, uncertainties in (or unrealism of) SCC estimates, and political feasibility. I suggest that even if we agree that all of these objections are on the right track or at least have a kernel of truth in their criticism of existing SCC-based recommendations, nonetheless the correct response to climate change still involves substantial emissions reductions to be achieved via policy, and the best methods for deciding the magnitude of those reductions still depend essentially on next generation versions of the SCC-based approach.

Worry: Too Much Mitigation, Because of Overly Pessimistic Assumptions About Technology and Adaptation

The first worry is that SCC-based analyses recommend too high of emissions reductions via too high of a carbon price (or other government controls), because SCC estimates ignore the possibility of exogenous technological solutions to climate change and more generally make highly uncertain and pessimistic assumptions about many other factors including endogenous technological change, adaptation, and many other things.[32]

There are many important dimensions to this worry. One dimension of the worry is simply that the GHG reductions that we should aim for with policy are actually less than SCC models tend to estimate, because the models ignore or have overly pessimistic assumptions about the propensity of technology to endogenously respond to problems when incentives and desire exist to do so (e.g. quickly innovate with new technology that reduces the carbon intensity of the economy more quickly than models assume and/or innovate with new technology to remove GHGs from the atmosphere).

In addition, a complementary worry is that the models do not comprehend exogenous technology changes that might solve the climate problem to some large extent in a way that is independent of climate policy-related incentives or preferences. For an oft-cited example, in the early 1900s there was great concern about the levels of horse manure accumulating on the streets of major cities. There was a lot of discussion about the correct policy to address horse manure, and there were many suggestions that radical intervention and policy controls were needed. But in fact the problem was solved entirely by exogenous technology changes—in other words changes that had nothing to do with any policy having to do with horse manure or any related effort to specifically address the horse manure problem. The solution was the unrelated and independent invention of the automobile and the decline of horse-driven transportation. Similarly, one might think that the arrival of e.g., cold fusion based on research that is not driven by climate policy or, perhaps more realistically, some combination of technology

that we haven't even imagined yet and that it will arise due to purely entrepreneurial and creative processes that have nothing to do with climate policy might largely deal with the climate problem effectively themselves.[33] The social cost of the carbon models do not comprehend these exogenous technology changes.

The preceding summarizes a number of ways the worry might arise that SCC models recommend too much government control based on overly pessimistic assumptions about technology and adaptation. If taken further and in a perhaps more libertarian direction, the worry could even be expressed that a Pigouvian tax as recommended by SCC estimates could even be net harmful to welfare versus something more in the direction of a more free market approach.

To begin to articulate a response to this worry, we can return to the preliminary observation from an earlier section that the true value of the social cost of carbon is positive, which everyone who takes climate change seriously is committed to. As a further a priori matter, we can note that as we move from zero to increasingly positive numbers for the SCC, every individual's confidence that the SCC is at least as high as the number in question will decrease. For any individual evaluating climate policy, there should thus be a positive SCC of quantity N such that the individual assigns very high confidence to the SCC being at least that value, as shown in Fig. 1.

With this in mind, we can see more clearly that much of the force of this worry is really about relying on central estimates of the SCC (as the Pigouvian approach does) rather than a more modest approach—and if we focus instead on a more modest carbon tax, much of the force of this worry dissipates. In other words, the important kernel of truth in this worry is really about over-reliance on central estimates from the SCC models—especially in connection with deterministic models from previous decades, which were based on particular estimates and structural assumptions of those specific instances of SCC models. SCC modelers acknowledge these worries and are already updating estimates to better explore uncertainty about the assumptions about technology, adaptation, and beyond (along with other important uncertain components, such as [especially] climate damages, climate sensitivity, and the climate system).[34]

These observations about the flexibility of the SCC approach and recent improvements in estimates are not a fully decisive reply to the worry in this section, which is that there is still too much pessimism even within the newest generation of SCC estimates. However, when these observations are combined with the arguments in sections above, including the possibility of a more modest SCC-based approach such as the Modest Carbon Tax, there are arguably straightforward ways for policy recommendations to take this worry on board, and there remain good reasons to endorse the SCC-based approach as at least one centrally important guide to climate policy.

Worry: Too Much Mitigation, Given Political Infeasibility and Counterproductive Blowback of Recommended Mitigation

With the preceding discussion in hand, the next important worry to consider is that the SCC-based approach recommends too high of emissions reductions via too high of a carbon price, because high carbon prices recommended by that approach would not be politically feasible and would lead to counterproductive blowback if implemented. As one real-world source of worry along this line, many would cite our experience with the Yellow Vests Movement and other protests in response to carbon pricing and related policies.

This is an important worry. One thing to note is that this is a worry not about the correctness of SCC estimates, but rather this is a worry about what policy should actually be implemented given the SCC, taking into account feasibility, political economy, and beyond. When this observation is combined with the arguments in sections above, including the possibility of a more modest SCC-based approach, arguably there are straightforward ways to revise policy recommendations in light of this worry (including simply moving in the direction of a more modest tax), and thus good reasons remain to endorse the SCC-based approach as at least one centrally important guide to climate policy.

Worry: Too Much Mitigation, Because Domestic SCC Is Only a Fraction of Global SCC

The next important worry to consider is that SCC-based analyses recommend too high of emissions reductions via too high of a carbon price, because they ignore the global collective action problem if they are interpreted as offering recommendations of what policies national governments should adopt.[35]

This is an important worry, especially as it is uncontroversial that, for example, the USA share of global climate damages is only somewhere on the order of 10–15% of global damages.[36] As a direct consequence, some commentators have argued that the correct carbon price to implement should only be 10–15% of the (global) SCC, since this would be the amount that internalizes the damages to USA citizens. Note again that this is a worry not about SCC estimates themselves, but rather about what policy should actually be implemented given these estimates, taking into account feasibility, political economy, and, in this case, the legitimate aims of domestic policymaking.[37]

At the same time, pushing back on this worry a little, even if we agree that there is an important kernel of truth here, it is important to emphasize that nations like the USA have self-interested reasons to spur cooperation on climate, and therefore they presumably have self-interested reasons to implement some climate action to spur global cooperative action. In addition, widely endorsed policy instruments such as border tax adjustments can mitigate this worry,[38] and the domestic use of revenue from a carbon tax[39] and decreased domestic air pollution[40] can generate large benefits domestically. And of course there are important normative arguments for focusing on the global social costs of carbon emissions as well as domestic costs.[41]

In sum, much like the previous points, some reason may emerge for favoring a more modest carbon tax than a Pigouvian tax based on the sum of the previous three worries. However, as we've seen there are straightforward ways to revise policy recommendations in light of this worry within the framework of the SCC approach (including simply moving in the direction of a more modest tax), and there remain other

good reasons to endorse the SCC-based approach as at least one centrally important guide to climate policy.

Worry: Too Little Mitigation, Because Worst-Case Scenarios Are Ignored and/or There Is Too Much Pure Time Preference (i.e., Impacts More Than a Century from Now Are Given Little Importance)

The next important worry to consider is that SCC-based analyses recommend too low of emissions reductions via too low of a carbon price, because SCC estimates ignore worst-case scenarios by focusing only on median parameter estimates or low-tail risk distributions across uncertain parameters, or they have too much pure time discounting.[42] This is an important worry, and we should be particularly mindful to acknowledge shortcomings of SCC estimates "on both sides," such as this worry that the SCC should be higher (in contrast to previous worries that in one sense or other put pressure in the other direction).

Unlike previous worries, this worry is really confined to specific parameter choices in SCC calculations, or specific deterministic model structures (rather than those that more adequately represent uncertainty, the range of possible outcomes, and expected value). In response, SCC estimates can be updated to whatever choice of parameters is desired, and next-generation models also aim to natively incorporate uncertainty. Thus, there are straightforward ways to revise policy recommendations in light of this worry, and, in fact, the most natural revisions assume the SCC framework for their implementation, so no reason emerges here to reject the SCC-based approach as at least one centrally important guide to climate policy.

Worry: Too Little Mitigation, Because Many Harms Are Not Accounted for, Especially Harm to the Poor, Oppressed, and Most Vulnerable

The next important worry to consider is that SCC-based analyses recommend too low of emissions reductions via too low of a carbon price,

because SCC estimates ignore many harms from climate change,[43] as well as inequalities within societies and the greater harm to the poor within societies from climate change,[44] including ignoring the possibilities for use of revenues from carbon taxes to alleviate poverty and inequality.[45] More controversially, it could be argued that SCC estimates ignore important harms to non-human animals and ecosystems.[46] This is an important worry, arguably correct when applied to specific SCC estimates of the past (see previous citations)—and it again highlights that we should be particularly careful to acknowledge shortcomings of SCC estimates "on both sides," such as this worry that the SCC should be higher (in contrast to previous worries in initial sections that in one sense or other put pressure in the other direction).

As with the previous worry, "internal" corrections within the SCC framework are the most natural way of taking this worry properly into account, which generates revised SCC estimates when (e.g.) "damage functions" are adjusted upward that describe the likely magnitude of the harms as a function of climate change. Exactly this kind of update is currently in progress for the main SCC estimates used in US government analyses, guided by recommendations from a recent National Academies report.[47] Again, no special reason emerges here to resist the SCC-based approach as at least one centrally important guide to climate policy.

Worry: Carbon Taxation Is the Wrong Mechanism for Emissions Reductions

Finally, a different important worry to consider is that carbon taxation and other policy controls recommended by SCC-based policy evaluations end up recommending the wrong mechanisms for emissions reductions, because (this worry claims) of the political infeasibility of carbon pricing as the sole mechanism for climate policy. Thus, according to some proponents of this, the superiority in some specific applications of command-and-control policies and governmental investment in subsidies and technology.[48]

This is an important worry and, like Worry 2, is a worry not about SCC estimates themselves, but rather about how they should be translated into policy, especially what policy instruments should be chosen to achieve emissions reductions. Furthermore, this issue does not immediately tell in the direction of more or less ambition, unlike the worries above.

However, if the upshot of this worry is that carbon pricing is needed but must be supplemented with large other policies, then it is possible that the optimal portfolio of policies might include (e.g.) a more modest carbon tax than a purely Pigouvian tax-based climate policy would recommend.

In sum, the preceding worries and responses indicate that even if we agree that all of these objections above to existing SCC-based analyses have an important kernel of truth, they do not undermine arguments that the correct response to climate change still involves substantial emissions reductions to be achieved via policy, and the best methods for deciding the magnitude of those reductions still depend essentially on the SCC-based approach. Indeed, many of these objections pull in opposite directions (i.e. in the direction of higher vs. lower estimates) and thus may in some cases offset one another to some important extent. The upshot is that even those who agree with these important worries do not thereby have good reason for wholesale rejection of policy guided by SCC estimates, and in fact they should still find action-guiding value in those estimates as one of the best available tools for deciding what we should do about climate change.

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Notes

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5. 95% confidence is arbitrarily chosen here, largely for purposes of a clear example and clear alternative with different properties than the Pigouvian tax approach. Who exactly should be in charge of estimating this confidence interval? It currently is the job of an interagency working group within the federal government, which in the future could be put under the administrative control of a more formal bipartisan institution. Note also that our confidence in the likely outcomes of policy might increase with experience, leading to ratcheting up of policy conditional on the success of a modest carbon tax.
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7. Tietenberg, *Economics*; see also Jonathan H. Adler, "The Legal and Administrative Risks of Climate Regulation," *Environmental Law Reporter* 51 (2021): 10485.

8. Some SCC models are more 'reduced form' in the sense that they only implicitly represent deaths, and in some cases do not explicitly represent the spatial distribution of damages. But many SCC models and model components are explicit in their representation of all of these things, i.e., deaths, economic losses, and their spatial distribution. See Delavane Diaz and Frances Moore, "Quantifying the Economic Risks of Climate Change," *Nature Climate Change* 7, no. 11 (November 2017): 774–782; *see also* National Academies, *Valuing Climate Damage*.
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12. Broome, "How Much."

13. Further complications arise if one considers deontological theories that cannot be easily represented as maximizing subject to side constraints—for more discussion see the literature on consequentializing deontological theories. See Paul Hurley, "Consequentializing," in *Oxford Handbook of Consequentialism*, ed. Douglas Portmore (Oxford: Oxford University Press, 2021), 24–35.
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16. Dennig et al., "Inequality"; Budolfson et al., "Utilitarian Benchmarks."
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18. See Mark Budolfson, "Market Failure, the Tragedy of the Commons, and Default Libertarianism in Contemporary Economics and Policy," in *Oxford Handbook of Freedom*, eds. David Schmidtz and Carmen Pavel (New York: Oxford University Press, 2017), 257–282; Mark Budolfson, "Arguments for Well-Regulated Capitalism, and Implications for Global Ethics, Food, Environment, Climate Change, and Beyond," *Ethics & International Affairs* 35, no. 1 (May 7, 2021): 83–98, https://doi.org/10.1017/s0892679421000083. Indeed, arguably for anything like economic liberalism to function adequately or in an ethically defensible

manner, something akin to a carbon price might be morally mandatory. Ibid.

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27. For example, almost all economists agree that carbon pricing is necessary in order to create needed economy-wide incentives to cause rational decarbonization across all aspects of society, which leaves open the possibility (as some have argued) that other complementary policies are necessary as well (e.g., investments in hydrogen, or direct air capture, etc.). See Heal, "Economic Aspects"; Stern, *Why Are We Waiting?*
28. Climate Leadership Council, "Economists' Statement."
29. Tietenberg, *Environmental and Natural Resource Economics.*
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47. National Academies, "Valuing Climate Damages."
48. Stern, *Why Are We Waiting?*; Heal, "Economic Aspects of the Energy Transition."