POLICY FORUM | CLIMATE POLICY

Keep climate policy focused on the social cost of carbon

JOSEPH E. ALDY, MATTHEW J. KOTCHEN, ROBERT N. STAVINS , AND , JAMES H. STOCK Authors Info & Affiliations

SCIENCE • 20 Aug 2021 • Vol 373, Issue 6557 • pp. 850-852 • DOI: 10.1126/science.abi7813

Abstract

In the context of climate change, the application of cost-benefit analysis to inform mitigation policies can help to achieve the best outcomes and avoid the worst: spending trillions of dollars but failing to get the job done (*1*). The costs of a climate policy are the abatement costs of reducing emissions of carbon dioxide (CO_2) (or other greenhouse gases). The standard measure of the benefits of a climate policy is the social cost of carbon (SCC), which measures the avoided economic damages associated with a metric ton of CO_2 emissions. Recently, however, there have been calls for an alternative approach to policy evaluation that ignores the benefits of avoided climate damages and instead focuses only on minimizing the compliance costs of a given, politically determined climate objective (*2*, *3*). We argue here that a shift from use of the SCC and cost-benefit analysis to an alternative approach for evaluating policy that focuses on costs alone would be misguided. Rather than advocate for alternative approaches, now is the time to support efforts to update the SCC and its application to official climate policy evaluation.

Get full access to this article

View all available purchase options and get full access to this article.

Supplementary Material

File (science.abi7813_sm.pdf)

DOWNLOAD

References and Notes

1. K. J. Arrow et al., *Science* **272**, 221 (1996).
CROSSREF · PUBMED · GOOGLE SCHOLAR

2. N. Stern, J. E. Stiglitz, *"The Social Cost of Carbon, Risk, Distribution, Market Failures: An Alternative Approach,"* working paper 28472 (National Bureau of Economic Research, 2021).
CROSSREF · GOOGLE SCHOLAR

3. N. Kaufman, A. R. Barron, W. Krawczyk, P. Marsters, H. McJeon, *Nat. Clim. Chang.* **10**, 1010 (2020).
CROSSREF · GOOGLE SCHOLAR

4. L. H. Goulder, R. N. Stavins, *Nature* **419**, 673 (2002).
CROSSREF · PUBMED · GOOGLE SCHOLAR

5. Interagency Working Group on Social Cost of Carbon, *"Technical support document: Social cost of carbon for regulatory impact analysis under executive order 12866" (plus technical updates in 2013, 2015, and 2016)* (US government, 2010).
GOOGLE SCHOLAR

6. J. Aldy et al., *"Environmental benefit-cost analysis: A comparative analysis between the United States and the United Kingdom,"* discussion paper 21-90 (Harvard Environmental Economics Program, January, 2021).
GOOGLE SCHOLAR

7. J. R. Biden, Executive order 13990 of January 20, 2021: Protecting public health and the environment and restoring science to tackle the climate crisis., *Fed. Regist.* **86**, 7037 (2021).
GOOGLE SCHOLAR

8. Interagency Working Group on Social Cost of Greenhouse Gases, *"Technical support document: Social cost of carbon, methane, and nitrous oxide, interim estimates under executive order 13990"* (US government, February 2021).
GOOGLE SCHOLAR

9. W. Pizer et al., *Science* **346**, 1189 (2014).
CROSSREF · PUBMED · GOOGLE SCHOLAR

10 V. Masson-Delmotte et al., Eds., "Global warming of 1.5°C," *Special Report* (IPCC, 2019).
GOOGLE SCHOLAR

11 J. Aldy et al., *Nat. Clim. Chang.* **6**, 1000 (2016).
CROSSREF · GOOGLE SCHOLAR

12 42 U.S. Code § 6295 - Energy Conservation Standards; www.law.cornell.edu/us-code/text/42/6295

13 National Academies of Sciences, Engineering, and Medicine. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide* (National Academies, 2017).
GOOGLE SCHOLAR

14 T. Carleton, M. Greenstone, *"Updating the United States government's social cost of carbon,"* working paper no. 2021-04 (Energy Policy Institute, University of Chicago, 2021).
GOOGLE SCHOLAR

15 G. Wagner et al., *Nature* **590**, 548 (2021).
CROSSREF · PUBMED · GOOGLE SCHOLAR

eLetters (1)

Terms of Service before submitting your own eLetter.

SUBMIT A RESPONSE TO THIS ARTICLE

OCT. 8, 2021

Broader frameworks are necessary for climate mitigation policies

ALOK BHARGAVA Professor of Public Policy, University of Maryland

In their article on climate policies, Aldy et al. (1) assert that the focus should be on social costs of carbon and that a "proposed shift away from SCC is ill advised". The authors dismiss approaches based on cost-effectiveness analyses as being "misguided". These blunt and seemingly superficial statements presumably stem from an emphasis on "macro" approaches (2) for modeling the effects of atmospheric greenhouse gases concentrations for *average* global surface and "deep-ocean" temperatures. By contrast, "micro" analyses underlying cost-effective policies will generally entail the use of *in situ* and remote sensing longitudinal data for analyzing the interrelationships between climate indicators such as GHG concentrations, ambient temperatures, ocean acidification, deoxygenation and current velocities, melting of sea and polar ice, and increased salinity and floods in coastal regions (3). From a broader analytical standpoint, the two approaches may be complementary especially since the assessment of long-term benefits of climate mitigation policies is complex.

First, a high proportion of CO_2 is ultimately absorbed by oceans thereby decreasing pH levels which, together with higher water temperatures, reduce dissolved oxygen levels (3). While SCC can cover ocean acidification, the emphasis on reducing GHG emissions (4) is inadequate for halting increases in temperatures because dumping pollutants in oceans (5) and lower pH levels can accelerate the melting of sea ice (6) and instigate feedback loops (7). Furthermore, GHG have different diffusion rates, potentials, solubility, and lifespans that are difficult to incorporate into SCC. While CH_4 may quickly diffuse into the atmosphere due to lower molecular weight, CO_2 emission from densely populated coastal regions are likely to be absorbed by the oceans. Thus, imputing SCC will need to account for carbon storage in the oceans which is difficult especially at lower depths.

Second, for the assessment of SCC, it is important to analyze factors such as the effects of agriculture for CH_4 and N_2O concentrations at weather stations (8). Moreover, CH_4 released from ocean floors partly dissolves in the water and the rest escapes into the atmosphere. While CH_4 has a shorter lifespan than CO_2, its warming potential is 23 times higher. Similarly, glacier and polar ice thicknesses are affected by aerosols from pollution and by the interplay between ice thicknesses and CO_2 and CH_4 releases from microbial activity (9, 10). Because glacier and sea ice thicknesses are important for maintaining water supplies and for earth's radiation budget, addressing such factors requires broader frameworks than a focus on SCC. Further, the effects of increased sea surface temperatures for zonal and meridional velocities of ocean currents (11) can take decades to materialize and may differentially affect warming patterns in the continents due velocity changes in the Atlantic Meridional Overturning Circulation (12). Lastly, even with better estimates of SCC, carbon taxes have been difficult to implement (13).

In summary, it is important to conduct elaborate studies on different dimensions of climate dynamics and incorporate the findings in evidence-based policies. While SCC is a useful measure, interventions preserving ocean health and those for maintaining polar ice and sea ice thicknesses are urgent and cannot be exclusively based on SCC. Moreover, many countries may be unwilling to pay carbon taxes and the redistribution of proceeds is unlikely to prevent inexorable increases in sea levels in the current economic and political environments. Rather than discussing the relative merits of cost-benefit versus cost-effectiveness approaches for climate mitigation policies, it would seem more important to persuade sparsely populated countries to admit larger numbers of climate migrants (14, 15).

REFERENCES

1. J. E. Aldy et al., *Science* **373**, 6557 (2021). (https://www.science.org/doi/10.1126/science.abi7813)
2. W.D. Nordhaus. *PNAS* 10.1073/pnas.1609244114 (2017) (https://www.pnas.org/content/114/7/1518)
3. A. Bhargava. *J. R. Stat Soc Series A* 10.1111/rssa.12732 (2021) (https://rss.onlinelibrary.wiley.com/doi/abs/10.1111/rssa.12732)

4. Intergovernmental Panel on Climate Change. C*limate Change 2014: Mitigation of climate change*.
5. M. Haward. *Nature Communications* 10.1038/s41467-018-03104-3 (2018) (https://www.nature.com/articles/s41467-018-03104-3)
6. Copernicus Climate Change Service (2019). *Sea ice area*. October, 2019 (https://cds.climate.copernicus.eu/#!/home)
7. M. Heimann, M. Reichstein, M. *Nature*, 451, 289-292 (2008). (https://www.nature.com/articles/nature06591)
8. World Data Centre for Greenhouse Gases. Data Archive. (2021) (https://gaw.kishou.go.jp/)
9. J.L. Wadham et al., *Nature Communications* 10:3567 10.1038/s41467-019-11394-4 (2019). (https://www.nature.com/articles/s41467-019-11394-4
10. GlaThiDa Consortium: *Glacier Thickness Database 3.0.1*. World Glacier Monitoring Service, 2019. (https://www.gtn-g.ch/data_catalogue_glathida/)
11. Ocean Surface Currents Analysis Real-time. 10.5067/OSCAR-03D01 (2021) (https://www.esr.org/research/oscar/oscar-surface-currents/)
12. M. Martin, M. Islar. *Sustainability Science* 10.1007/s11625-020-00877-9 (2021) (https://link.springer.com/article/10.1007/s11625-020-00877-9)
13. L. Caesar et al., *Nature Geosciences*, 10.1038/s41561-021-00699-z (2021) (https://www.nature.com/articles/s41561-021-00699-z)
14. E. Piguet. Environment and migration (2019) (https://libra.unine.ch/export/DL/42636.pdf)
15. A. Bhargava A. *Econ Hum Biol*, 33, 149-154. (2019) (https://www.sciencedirect.com/science/article/abs/pii/S1570677X1)