Considering health damages and co-benefits in climate change policy assessment

In early 2021, US President Joe Biden signed an executive order to revise the social cost of carbon estimate used by the US Government. The social cost of carbon is a monetary estimate of the harms of climate change that can be applied when developing policy and making decisions on fossil fuel extraction, infrastructure projects, and emissions reductions.

Using a higher social cost of carbon in the USA has been the subject of recent court rulings. In February, 2022, a federal judge in Louisiana blocked the Biden administration from using a higher social cost of carbon of US$51 per tonne of CO_2 (compared with the $7 per tonne of CO_2 used by the Trump administration).[1] Although the US Supreme Court has now allowed the higher social cost of carbon to be used,[2] other court challenges are targeting climate change policies.[3]

Key components of calculating the social cost of carbon are damage functions that model the impacts of climate change.[4] Damage functions have been part of many assessments of the potential effects of climate change using integrated assessment models (IAMs). A well known example is Professor Nicholas Stern's *The Economics of Climate Change*.[5] Stern has stated that inadequate modelling of human wellbeing and loss of life was one reason that IAMs provide social cost of carbon estimates that "are often way too low".[6] Others argue that the damage functions used by IAMs are highly unknowable and that carbon pricing should instead be based on the marginal cost of abating emissions.[7]

Standard damage functions in existing IAMs rarely capture the heterogeneity in damages across countries and within countries. For example, a 2018 study using limited damage functions (mainly losses in agricultural and labour productivity from heat stress) found that if the global surface temperature increases by 4°C by 2100, the effect on gross domestic product (GDP) would be most severe in parts of Africa (eg, GDP would decrease by an estimated 27% in Togo), followed by southeast Asia (eg, estimated decrease of 21% in the Philippines), and south Asia (eg, estimated decrease of 15% in India).[8] By contrast, GDP would decrease by less than 1% in the USA, Canada, and central and northern Europe.[8] Another relevant example is the finding that climate zones are a key determinant of the proportion of mortality associated with extremely hot and cold temperatures.[9]

Disaggregating market and non-market climate damages by region and sector was a recommendation for the Interagency Working Group on the Social Cost of Carbon.[10] Regional and subnational damage functions would better capture the diverse range of climate change impacts, especially for human health. Although accounting for a broader set of benefits and harms will pose a substantial methodological challenge, there are outcome measures that combine mortality and morbidity effects, such as the quality-adjusted life year and disability-adjusted life year, which might be used or adapted for this purpose.

An alternative to global and all-encompassing damage functions are assessments of health-based co-benefits (or win–win outcomes) that are associated with a single intervention or specific policy change. For example, studies using IAMs have found that reducing the use of coal for power generation will lead to health co-benefits that outweigh the economic cost of decarbonisation policies due to decreased local air pollution.[11,12] A range of health issues should be considered when assessing the multiple co-benefits and potential unintended co-harms of climate policies in different sectors. For example, urban planning policies that encourage active travel (eg, walking and cycling) instead of motorised transport can reduce pollutant emissions, noise, and congestion, and help improve physical activity levels in the population.[13]

Our health is valuable, and applying a social cost of carbon or calculating health-based co-benefits will improve local decisions on fossil fuel extraction, infrastructure projects, and greenhouse gas emissions reductions.

We declare no competing interests. We are members of the Healthy Environments And Lives National Research Network, which receives funding from the National Health and Medical Research Council special initiative in Human Health and Environmental Change (grant number 2008937).

*Thomas Longden, Tom Kompas, Richard Norman, Sotiris Vardoulakis
thomas.longden@anu.edu.au

Crawford School of Public Policy, Australian National University, Canberra, ACT, Australia (TL, SV); Centre of Excellence for Biosecurity Risk Analysis, School of Biosciences and School of Ecosystem and Forest Sciences, University of Melbourne, Melbourne, VIC, Australia (TK); Curtin School of Population Health, Curtin University, Perth, WA, Australia (RN), National Centre for Epidemiology and Population Health, Australian National University, Canberra, ACT, Australia (SV)

1 Joselow M. Court ruling on social cost of carbon upends Biden's climate plans. The Washington Post. https://www.washingtonpost.com/climate-environment/2022/02/21/social-cost-of-carbon-biden/ (accessed July 1, 2022).
2 Stohr G. Biden's climate costs for major projects survive court challenge. Bloomberg. https://www.bloomberg.com/news/articles/2022-05-26/supreme-court-allows-biden-to-keep-using-climate-cost-estimates (accessed July 1, 2022).
3 Joselow M. Supreme Court's EPA ruling upends Biden's environmental agenda. The Washington Post. https://www.washingtonpost.com/climate-environment/2022/06/30/epa-supreme-court-west-virginia/ (accessed July 1, 2022).
4 Nordhaus WD. Revisiting the social cost of carbon. *Proc Natl Acad Sci USA* 2017; **114:** 1518–23.
5 Stern N. The economics of climate change. *Am Econ Rev* 2008; **98:** 1–37.
6 Stern N. Economics: current climate models are grossly misleading. *Nature* 2016; **530:** 407–09.
7 Pezzey JCV. Why the social cost of carbon will always be disputed. *Wiley Interdiscip Rev Clim Change* 2019; **10:** e558.

8 Kompas T, Pham VH, Che TN. The effects of climate change on GDP by country and the global economic gains from complying with the Paris Climate Accord. *Earths Futur* 2018; **6:** 1153–73.

9 Longden T. The impact of temperature on mortality across different climate zones. *Clim Change* 2019; **157:** 221–42.

10 National Academies of Sciences, Engineering, and Medicine. Valuing climate damages: updating estimation of the social cost of carbon dioxide. Washington, DC: The National Academies Press, 2017.

11 Schwanitz VJ, Longden T, Knopf B, Capros P. The implications of initiating immediate climate change mitigation—a potential for co-benefits? *Technol Forecast Soc Change* 2015; **90:** 166–77.

12 Rauner S, Bauer N, Dirnaichner A, Van Dingenen R, Mutel C, Luderer G. Coal-exit health and environmental damage reductions outweigh economic impacts. *Nat Clim Chang* 2020; **10:** 308–12.

13 Haines A, Ebi K. The imperative for climate action to protect health. *N Engl J Med* 2019; **380:** 263–73.